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**Edition 2**

# NATO Secondary Imagery Format (NSIF) STANAG 4545 (Edition 2)
# Implementation Guide

**July 2012**

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NORTH ATLANTIC TREATY ORGANIZATION

NATO STANDARDIZATION AGENCY (NSA)

NATO LETTER OF PROMULGATION

July 2012

1. AEDP-4 (Edition 2) - NATO Secondary Imagery Format (NSIF) STANAG 4545 (Edition 2) IMPLEMENTATION GUIDE is a NATO UNCLASSIFIED publication.

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Brigadier General, POL(A)
Director, NSA

# Record Of Changes

| Change Date | Date entered | Effective Date | By Whom Entered |
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| | | | |

# Record of Reservations

| Reservation | Nation |
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# Foreword

This document provides the North Atlantic Treaty Organization (NATO) Secondary Imagery Format (NSIF) community with technical guidance on developing and testing implementations of NSIF. NSIF is the standard for formatting and exchanging digital secondary imagery and imagery related products between NATO nations. The NSIF standard is part of a family of standards that are assembled under NATO Joint ISR Capability Group to ensure interoperability in the exchange of multi-national intelligence and reconnaissance information.

The NATO Air Group IV (now Joint Capability Group on ISR), NSIF Custodial Support Team (NSIF CST) developed this document in accordance with current NATO procedures and guidelines under the direction and oversight of the NSIF Custodian. Forward all comments, recommendations, additions, deletions, and other pertinent data that may be of use in improving this document to:

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## 1.0 OBJECTIVES

The aim of the NATO Secondary Imagery Format (NSIF) is to promote interoperability for the exchange of imagery among North Atlantic Treaty Organization (NATO) Command, Control, Communications, Computers and Intelligence ($C^4I$) Systems. The NATO Secondary Imagery Format (NSIF) is the standard for formatting digital imagery files and imagery-related products and exchanging them among NATO members. STANAG 4545 is supported by a collection of related standards and specifications, implementation profiles and data extensions which can collectively be called NSIF; these were developed to provide a foundation for interoperability in the dissemination of imagery and imagery-related products among different computer systems.

## 2.0 PHILOSOPHY

STANAG 4545 NSIF defines a format based on a specified order of imagery, graphic, textual and supporting data segments in the file, combined with fixed length fields within the segments headers and subheaders. A STANAG 4545 compliant file header defines the number of instances of each segment type, as well as the size of each segment subheader and segment data. This structure allows specific fields to be located by using byte-offsets from the beginning of the file. Within each segment, conditional fields are inserted based on values in associated required fields, so the total byte offset of each subheader is based on the fields desired and values of other specified fields.

Given that NSIF provides for multiple images, graphics, text, and data extension segments, it also provides the relative orientation of each with respect to the other segments in the file. A coordinate system is used to properly position the representations of each segment, and attachment and display level designations provide for proper display overlaying and parent child relationship connections between the display of the file's segments.

NSIF also includes provisions for additional types and volumes of data that were not anticipated at the time the standard was created. Data Extension Segments can be added to carry additional types of data, to supplement the other segments, with extensions to provide a means for incorporating more data than allowed with the byte counts of the other headers. The format also includes provisions for user-defined data. By providing a single format in which imagery, graphic annotations, text, and other data can be incorporated into a single file, $C^4I$ systems can exchange the data around the battlefield with other systems maintaining interoperability.

Given the inherent situation that standards tend to be flexible to interpretation, it is intended that this AEDP-4 will begin to close down this risk on interoperable collection and exchange between STANAG 4545 compliant systems.

## 3.0 AEDP SCOPE

This document includes technical guidance information for developing and testing implementations of NSIF.

*Note: At the time of publication of this edition of AEDP-4, the STANAG 4545 Custodial Support Team (CST) has approved the inclusion of Universal Polar Stereographic (UPS) as a projection code for imagery in this document. This results in required amendments to the NSIF Profile of BIIF yet to be completed. Because the inclusion of UPS will impact new and existing systems development, initial documentation for UPS has been added to this document with caveats to that effect.*

The sections of this document are as follows:

Annex A: Implementation Guidance

Annex B: Sample Implementation

Annex C: NSIF Test Criteria (NTC)

Annex D: Test Criteria for JPEG 2000 Data in STANAG 4545

Annex E: NSIF Approved Support Data Extension Listing

Annex F: NSIF Configuration Management Plan

Annex G: Forms for Requesting Changes to Documents Or Proposing New Extensions

Annex H: DIGEST Extensions Errata/Configuration Management

# ANNEX A Implementation Guidance

## GENERAL

This Annex contains general or explanatory information that may be helpful but is not mandatory in developing implementations of NSIF. Significant additional implementation practices may be found in the IPON (STDI-0005) (see ANNEX C below).

### 1. NSIF Implementation Guidelines.

The NSIF has been developed to provide digital image exchange capabilities among computer systems of various designs and capabilities. This Annex will discuss general considerations pertinent to successful NSIF implementation. Guidelines will be presented, and potential problems will be highlighted. The NSIF pre-processor and post-processor software, the software necessary to write and read a NSIF File based on host files containing the Segments to be included, are to be written by the user. The combination of the pre-processor and post-processor hereafter will be referred to as the NSIF implementation. Pre-processing is sometimes called packing (generating), and post-processing is called unpacking (interpreting). NSIF implementation sample software is available through your point of contact. NSIF implementations will be able to pack and unpack National Imagery Transmission Format Version 2.1 (NITF 2.1) files as defined in MIL-STD-2500C and Version 2.0 (NITF 2.0) files (MIL-STD-2500A with change notices 1 through 3) for interoperability considerations.

## GENERAL REQUIREMENTS

### 2. Scope of NSIF Implementation.

NSIF describes the format of digital images, Computer Graphic Metafile (CGM) graphics, text data and metadata that may be present within the NSIF file. It does not define the image graphic or text requirements of the host system. The host system is responsible for the handling of unpacked image, graphic, and text data, as well as image, graphic and text display capabilities.

### 3. Creating NSIF Headers and NSIF Subheaders.

STANAG 4545 specifies legal values for the NSIF file's header and subheader fields. The NSIF pre-processor for any particular host system will be responsible for enforcing the field values as stated in this standard.

### 4. Byte Counts.

The STANAG 4545 uses explicit byte counts to delimit fields. No end-of-field characters are used. These byte counts are critical for the proper interpretation of a STANAG 4545 compliant file. The NSIF pre-processor should compute these byte counts based on the NSIF file's contents to ensure accuracy. All fields in the NSIF file header and subheaders must be present exactly as specified in the STANAG 4545 file header and subheader descriptions, and no additional fields or data outside the field value range may be inserted. The STANAG 4545 uses various conditional fields whose presence is determined by previous fields and counts. If an expected conditional field of the file header or subheader is missing, the remainder of the NSIF file data would shift and will be misinterpreted. A similar result will occur if a conditional field is inserted when it is not required. For these reasons, the header and subheader field counts are critical, and every effort must be made to ensure their accuracy. The NSIF pre-processor should compute these counts based on the NSIF file contents whenever possible.

5. Data Entry.

To reduce any operator workload imposed by the pre-processor, each pre-processor should provide for the automatic entry of data. Global default values for the particular NSIF Version should be inserted automatically in the NSIF File. System default values, such as the standard size parameters for an image, also should be entered automatically by the pre-processor. NSIF header and subheader values that are known to that system and imagery application, such as the time or the computed size of an overlay, also should be entered automatically.

6. User-Defined NSIF File Header and User-Defined Image Subheader Data Fields.

Users may need to provide additional data in support of a NSIF file. To accommodate this requirement, conditional user-defined Data Fields are provided in the NSIF File Header and Image Subheader. One potential use for the user-defined Image Subheader Data Field is to provide space for directly associating acquisition parameters with the image. Use of the user-defined Header and user-defined Image Subheader Data Fields requires insertion of Tagged Record Extensions (TREs) that implement the extension as described in STANAG 4545. Most TREs are described in STDI-0002. Before use, TREs shall be registered with the Custodian according to procedures available from the Custodian. This procedure ensures that different users will not use the same TRE identifier to flag different extended data sets. It also provides for configuration management of TRE formats where the extended data are expected to be used by a wide audience of users.

6.1 Handling the Extended and User-Defined Header and Subheader Fields. The NSIF has made allowances for additional enhancements by defining fields for holding Tagged Record Extensions (TREs). These are the Extended Header Data field of the main header and the Extended Subheader Data fields of all sub-headers; the User-Defined Header Data field of the main header and User Define Image Tagged Data field of the image subheader; and the TRE Overflow Data Extension Segment (DES). The contents of all of these fields may or may not be under configuration control. These TRE fields, or their corresponding TRE Overflow DES, should not be used except as provided for in documentation available from the Custodian. These header and subheader fields, used for recording TREs, are composed of a header/subheader byte count field, an overflow indicator field, and a data field. These extended and user-defined data byte counts shall be extracted by the file-reading software, and the appropriate number of TRE bytes shall be read or bypassed. Both Extended and User-Defined header and subheader fields are used in the current NSIF. Use of these fields must be coordinated with the Custodian by registration, but the contents of these fields are not under configuration management. Implementers are reminded that the TRE contents of these header and subheader fields (or, if present in the file, their corresponding TRE Overflow DES) must be processed properly or ignored by the file reading software if the TREs that are encountered are not supported. See: Annex C 27 a (3) TRE Placement, in the NSIF Profile of BIIF rev 2 (ISO/IEC BIIF Profile NSIF01.01).

7. Out-of-Bounds Field Values.

The NSIF File creator is responsible for ensuring that all NSIF header and subheader field values are within the bounds specified by the STANAG 4545 document. An out-of-bounds value in a NSIF field indicates that either an error occurred or that the sending station was not in full compliance with STANAG 4545 format.

8. Use of Images in NSIF.

The STANAG 4545 specifies a format for digital images contained within a NSIF file only. A STANAG 4545 compliant implementation must be capable of translating this format to and from the host system's local format. Some host systems have multiple formats for binary data. In these cases, the NSIF implementation must use the appropriate host format to provide the necessary data exchange services with other system packages. When imagery data of N bits-per-pixel is displayed on an M-bit ($2^M$ grey shades) display device (N < M), it must be transformed into the dynamic range of the device. One way to do this is to modify the Look Up Tables (LUTs) of the display device (not to be confused with the LUT in the NSIF subheader). However, if M-bit and N-bit imagery is displayed simultaneously, the M-bit image will appear distorted. The recommended method is to convert the N-bit imagery into M-bit imagery, then use the standard hardware LUTs. The following equation will transform a N-bit pixel into an M-bit pixel:

| | | |
|---|---|---|
| M | = | number of bits-per-pixel of display device |
| N | = | number of bits-per-pixel of image (Table C-1-3, field ABPP) where N < M |
| $P_N$ | = | N-bit pixel value |
| $P_M$ | = | M-bit pixel value |

$$P_M = \frac{2^M - 1}{2^N - 1} P_N$$

(Note: $P_M$ must be converted to an integer value by rounding, truncation or some other method).

9. Use of Annotations (Graphics)

Graphics used by NSIF producers will be in accordance with the Computer Graphics Metafile (CGM) defined in the BIIF Profile for CGM (BPCGM01.00). Interpreters that are required to be backward compatible with NITF 2.0 (MIL-STD-2500A and change notices 1 through 3) files for graphics (symbols and labels), will also have to accommodate labels and bit-mapped symbols defined in MIL-STD-2500A.

10. Use of Text in STANAG 4545 Files.

The TXTFMT field within the text segment subheader is provided to help the NSIF file reader determine how and in what format the text data was encoded for interpretation. The NSIF file reader is responsible for interpreting the various text data formats and associated character sets. Character set designations explicitly supported by the NSIF are addressed in the standard (Table A-3. NSIF 1-Byte Coded Characters and Table A-4. NSIF 2-Byte Coded Characters).

11. Formatted Documents.

The STANAG 4545 compliant file Text Segment is intended to convey textual data, not marked up text typically found in word processed documents. In the future, formatted documents, e.g., Standardized Graphic Mark-up Language (SGML), Hypertext Mark-up Language (HTML), Rich Text Format (RTF), etc. may be accommodated using a specialized TRE or DES. Specifically, the XML_DATA_CONTENT DES is available for this purpose. Others may be defined in the future.

12. Converting Color to Grey Scale.

Full color (3-band 24-bit data) may be specified as the file background (FBKGC in ISO/IEC BIIF PROFILE NSIF01.01) and for various attributes of segments within a NSIF file (e.g. color imagery [including 24 bit, 36 bit, 48 bit, etc.] and color graphics). Receiving systems unable to support the presentation of full colors must map the full colors to a set of supported colors (reduced colors or monochrome) for display, ensuring all data is displayed and recognizable to the operator.

12.1 <u>Eight-bit Grey Scale Presentation</u>. For 8-bit grey scale systems an appropriate conversion for 24 bit color data is:

GREY (8-bit) = 0.299*RED + 0.587*GREEN + 0.114*BLUE

12.2 <u>One-bit Grey Scale Presentation</u>. For 1-bit bi-tonal (e.g. black and white) systems, an appropriate conversion is to first calculate the grey scale conversion as shown above. Then,

BITONE(1-bit) = 1 (white), when GREY (8-bit) > 127

BITONE(1-bit) = 0 (black), when GREY (8-bit) <= 127

12.3 <u>Greater Than Eight-bit Grey Scale Presentation</u>. For 8+ bit grey scale systems, color components can first be converted to 8-bit grey scale followed by a dynamic range adjustment to the bit range supported by the presentation device.

12.4 <u>Washout</u>. The potential exists for overlay segments to be inadvertently hidden or washed out when compared to the background over which they are placed, particularly when converting from color to grey scale. The pack application developer should take a design approach that obviates the potential for a recipient to inadvertently overlook presentation material caused by inadequate lack of contrast in the presentation. For example, use a background color of gray so that both white and black annotation will be seen.

13. File System Constraints.

The translation of NSIF files to and from the local or native file format for a system should be examined for potential incompatibilities before an implementation is attempted. This includes the structure of the image, the associated metadata, and spatial referencing. In addition, format related issues should be examined, such as organization of data elements, byte counts, and format-unique header information. An NSIF file is presented as a stream of contiguous bytes. This format may not be suitable for some file systems to translate as intended by the generating system.

14. Security Considerations.

A STANAG 4545 compliant file contains sufficient security information in the format file header, subheaders and the Releasability (RELCCA) TRE to allow implementers to meet virtually any security requirement for protecting and displaying classified data. Appropriate accreditation authorities or specific user requirements generally specify exact security information handling requirements. It is suggested that NSIF implementations display a classification banner identified in the NSIF file header and ensure that the information is always displayed whenever the NSIF file is displayed. It should be noted that while the security codes designators use national security codes, these codes should not be confused with the country codes defined in STANAG 1059, FIPS 10-4 and ISO 3166 and the intended uses of those codes.

15. NSIF Printer Incompatibilities.

Some printers do not support printing transparent pixel data in imagery (e.g., Postscript level 1 and 2). If an NSIF composition uses CGM elements under images with NSIF image padding (transparent pixels), the CGM will not be visibly printed in any areas under the pad pixels.

16. Universal Transverse Mercator (UTM) Coordinate Hemisphere Resolution.

The Image Coordinate Representation (ICORDS) field in an image segment subheader allows a single character value for an image's UTM hemispheric designation, N for northern or S for southern. (See Figure A-1 for a general description of the UTM structure.) When the Image Geographic Location (IGEOLO) field is filled with UTM coordinates, image presentations that cross the Equator have northing values that are ambiguous, and it is not immediately obvious which corners are on which side of the Equator. Given their UTM coordinates and zone, the following method resolves the hemispheric designation of four individual corners of an image.

16.1 North (N)/South (S) Method. When used for pure UTM coordinates, the ICORDS contains one of two values: N if the northernmost corner is on or north of the Equator, S if the northern most point is south of the Equator. When the ICORDS field contains S, all 4 corners are south of the Equator. When the ICORDS field contains N, the following process resolves the hemispheres of the individual corners:

16.1.1 Initially assume that the north-south spread of the image is within 5000km (about 45 degrees). Some images are currently produced that exceed 5000km. Some image mosaics extend to include the entire Earth.

16.1.2 Compute the smallest northing (nmin) from the 4 corners. (The corner with that northing value is certain to be one of the corners on or north of the Equator.)

16.1.3 Then any corner with a northing in excess of [nmin + 5 million] is located south of the Equator. Any northing with a northing not exceeding [nmin + 5 million] is located on or north of the Equator.

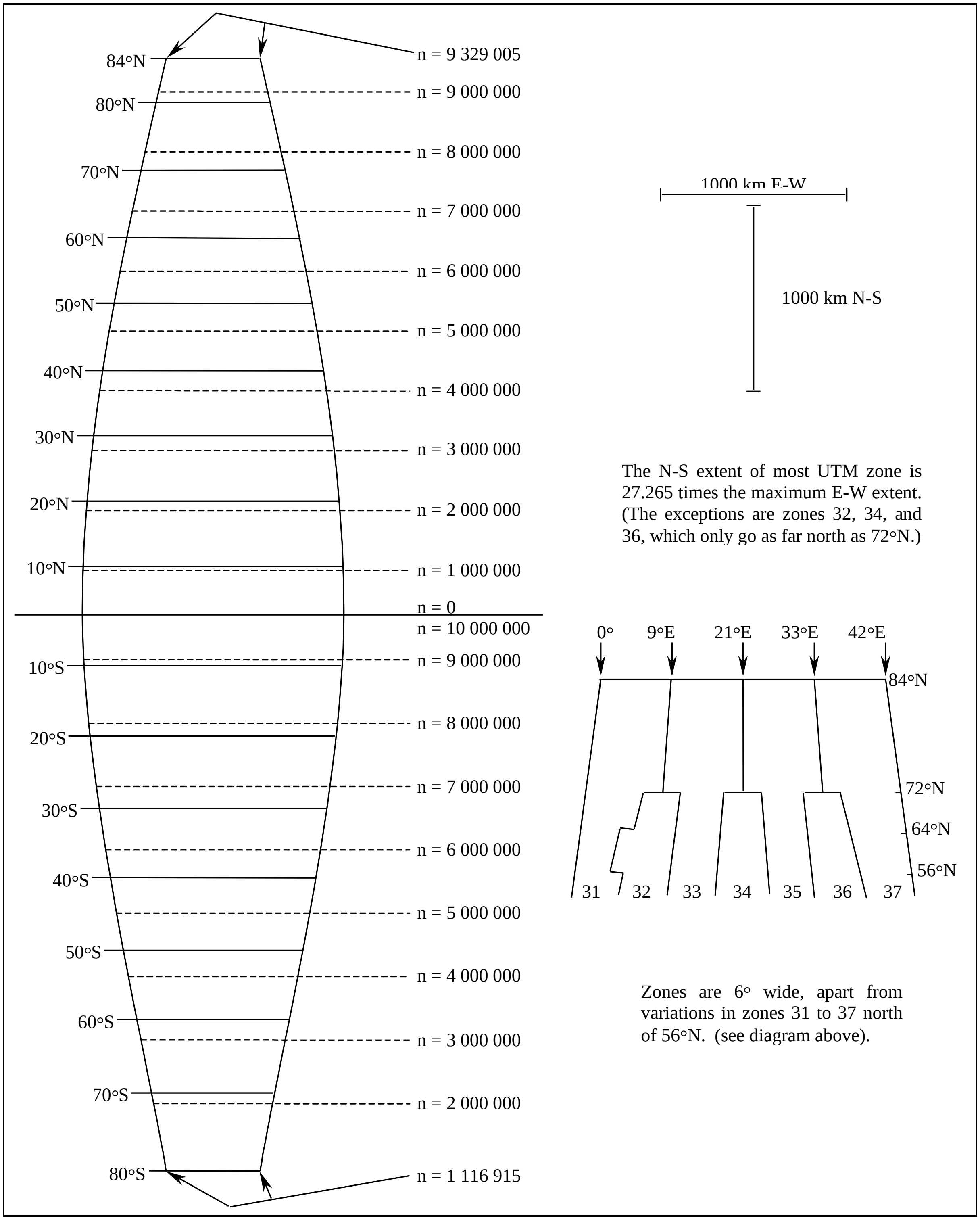


**Figure A-1. A Typical World Geodetic System 84 (WGS 84) Universal Transverse Mercator (UTM) Zone (Compressed)**

17. Image Geographic Location Field (IGEOLO).

17.1 When populated, the STANAG 4545 image subheader IGEOLO field provides a bounding polygon (four points) for the coverage of the image data on the earth. The coordinates in these fields are intended to provide general orientation/coverage only, and are not intended for any interpretation other than to establish the approximate location on the earth (e.g. for data discovery/retrieval purposes). For applications that require precise and accurate location information, the use of support data from appropriate TREs is required.

17.2 To help meet tight production and dissemination timelines, some imagery collection and production systems are known to populate IGEOLO with rough approximations of the corner points even when the actual imagery products have support data (TREs) that allows more accurate and precise determination of the corner point geographical locations. This practice can result in an exploitation/mensuration tools getting different geographical location values for the corner points when using the support data as compared to those populated in the IGEOLO field. Applications/tools that present geographical coordinates to the user need to have some readily apparent means to identify the source of data and means for calculating positional values. e.g. derived from linear interpolation from IGEOLO corner point values or grid point matrices, RPC equations, camera model parameters, replacement camera model, with or without use of elevation data, etc.

17.3 When four corner points are included in the file and the image is not covering the entire image display space the corner points may not represent the corner pixel in the displayed image. In these cases, the IGEOLO values should represent the meaningful ground coverage of the image. The corner point should represent the pixel where the intelligent ground point is. For example, where a horizon is in the image the corner point would not represent the point in the sky but rather the point on the ground near the horizon. (The use of SENSRB TRE, or other TREs, are recommended to provide exploitation and mensuration tools sufficient means to accurately derive the image geospatial coverage.)

The Figure A-2 below presents examples of this situation.

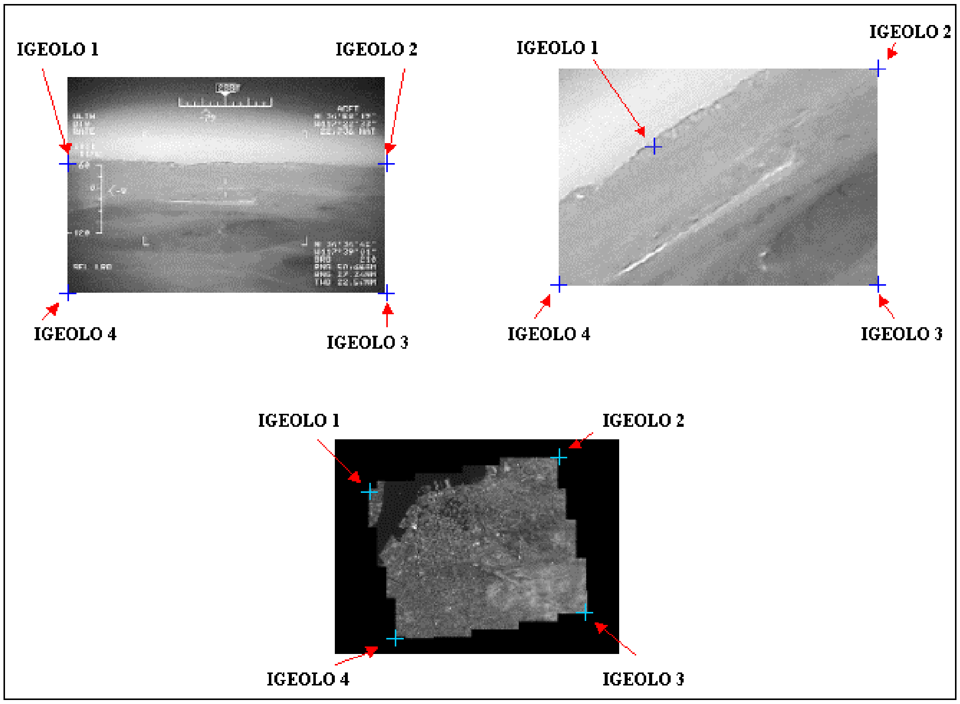


**Figure A-2. IGEOLO When the Image Does Not Cover the Entire Display Space**

17.4 When the image segment is used to record a single pixel or a line of data (e.g. documenting a multispectral sample with a single pixel from each of multiple bands), the ICORDS field will be filled with spaces and the IGEOLO will be omitted, since the relationship to a geographic location is not meaningful.

If a single pixel or line of data does have a meaningful geographic location or if the ground footprint of a multi-line image is so small as to be less than the number of significant digits of the IGEOLO field then all four values of the IGEOLO field shall be the same. In this case the system should add or subtract a small fraction of a sec of arc from each corner value, enough to allow the system to calculate the geolocation of the pixel or pixels. It is recommended that the BLOCKA TRE may be used to help describe the geographic field.

18. Coordinate Datums

Misunderstanding the differences between Geodetic (Geographic) and Geocentric coordinate systems, due to unclear descriptions in the IGEOLO field, may result in a product that is not accurately represented. The following paragraphs attempt to explain the difference between the coordinate systems and why making the correct choice is important. Coordinate systems are based off of different datum; which can be defined as a point, line, or surface selected as the origin or reference for measurements. The Geodetic coordinate system is referenced to an ellipsoid. The coordinates obtained from this system are normally in decimal degrees or degrees-minutes-seconds. The Figure A-3 below is an illustration of how the *geodetic latitude* is found:

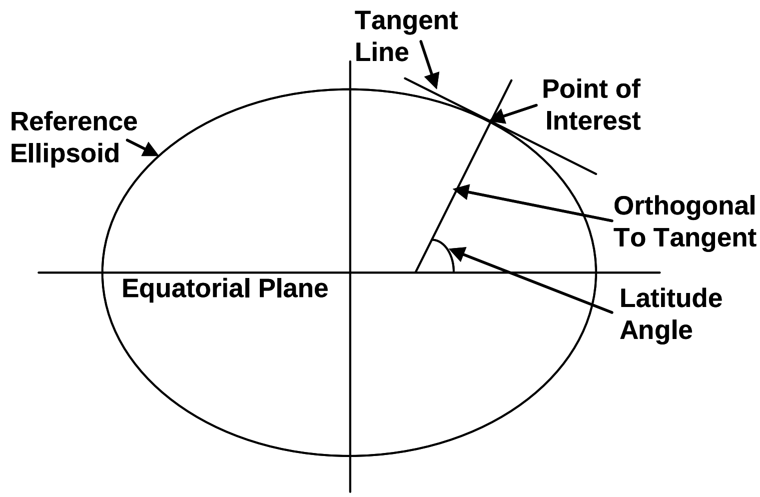


**Figure A-3. Geodetic Latitude**

A tangent line is drawn through the point of interest, and a 90° angle is made with the tangent line. The angle made between the 90° angle line and the equatorial plane is the geodetic latitude of the point. Notice the 90° angle line does not pass through the center of ellipsoid model of the Earth.

The Geocentric coordinate system uses a sphere as the referenced datum. The coordinates obtained from the geocentric system are based on X, Y, and Z axes. Figure A-4 below shows how *geocentric latitude* is acquired:

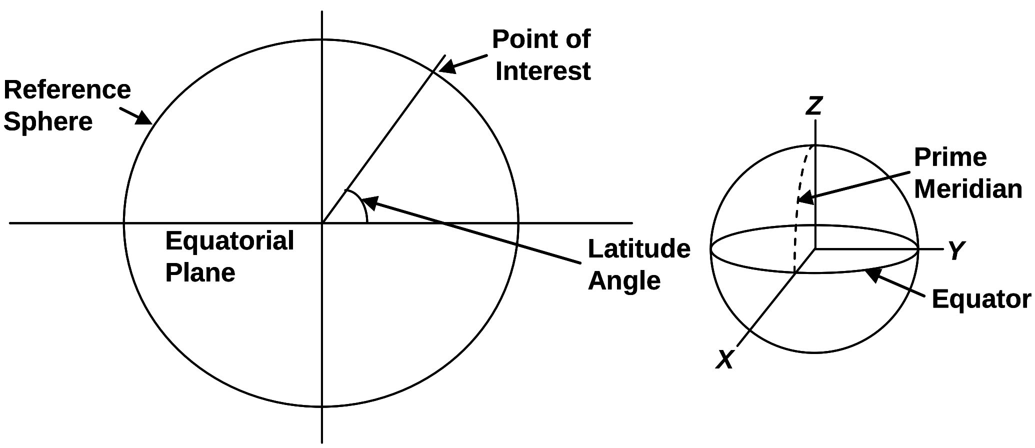


**Figure A-4. Geocentric Latitude**

The latitude for a Geocentric coordinate is established by drawing a straight line from the center of the earth to the point of interest. The angle made between this line and the equatorial plane is the latitude of the point.

The longitude will remain equal in both systems; it is only the latitude that is affected by different types of coordinate systems.

If the geocentric selection is used for the input of the field ICORDS and the selection should be geodetic, depending on what the latitude is, there can be an offset from 0 to 11.5 minutes of latitude. Each minute in a degree is equal to approximately one mile, therefore, an error of 11.5 miles can occur in the final product (see figure and table below).

| Geodetic Latitude | Geocentric Latitude | Difference (Minutes) |
|---|---|---|
| 0.000 | 0.000 | 0 |
| 15 | 14.904 | 5.8 |
| 30 | 29.834 | 10 |
| 45 | 44.808 | 11.5 |
| 60 | 59.833 | 10 |
| 75 | 74.904 | 5.8 |
| 89 | 88.993 | 0.4 |
| 90 | 90 | 0 |

**Table A-1. Geodetic vs. Geocentric Latitude**

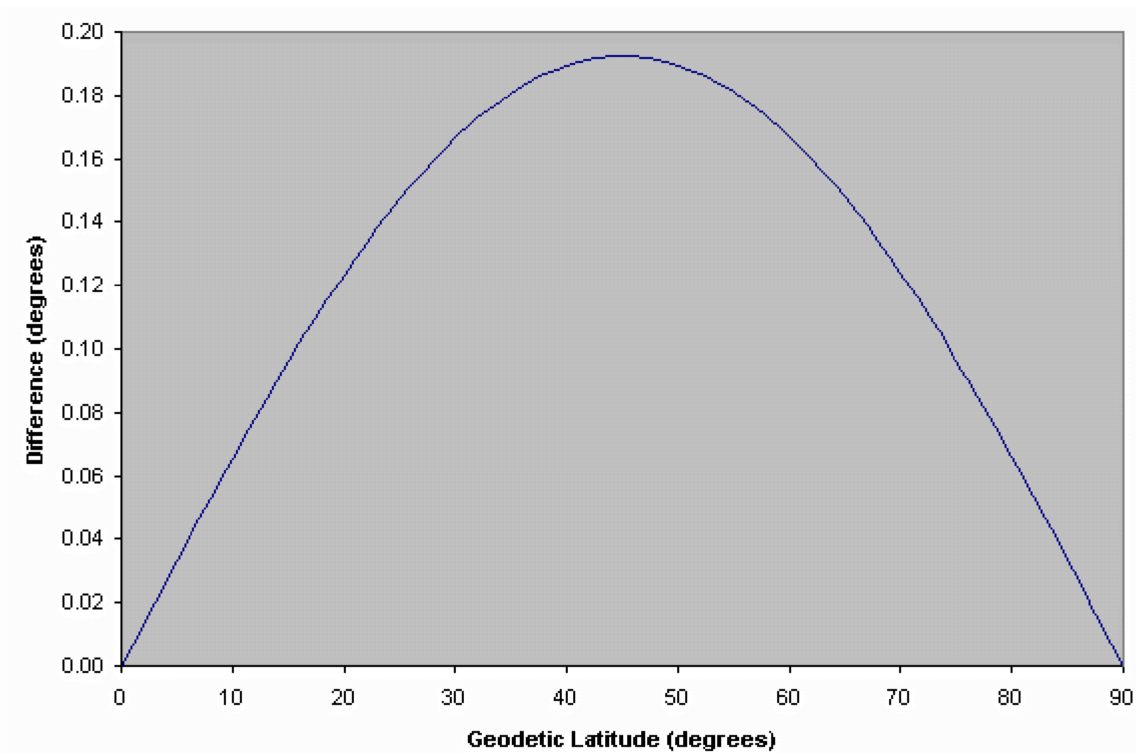


**Figure A-5. Geodetic vs. Geocentric Latitude Difference in Degrees**

The type of datum used in the product needs to be known in order to determine the difference between Geodetic and Geocentric systems. *Geocentric* implies a *spherical* Earth model while *Geodetic* implies an *ellipsoidal* Earth model. Most of the data that are commonly used today are based from an ellipsoidal model, which means many of the coordinate systems used are Geodetic. An example of a common datum used today is the WGS84. Coordinates from this datum would be considered Geodetic.

WGS84 is the default datum as specified in the ICORDS field of the NSIF profile of BIIF (NSIF01.01)

## 19. Utilization of SDEs for Geocoding

There exist a considerable number of Support Data Extensions (SDEs) to supply geodetic information. An SDE is a collection of one or more Tagged Record Extensions (TREs). In the special case where an SDE refers to a single TRE then the terms are interchangeable. The following table outlines the proper use of these SDEs: If the capabilities at the production site are given, the figure may be read from left to right. Otherwise, read it from right to left to find out which instruments can accomplish a certain task.

**Table A-2. Use of SDEs**

| ***Case*** | ***Capabilities at image production site or at platform*** | | ***Instrument to provide geolocation information*** | ***Additional assumptions necessary*** | ***Product to be delivered*** |
|---|---|---|---|---|---|
| 1 | Imagery can be rectified and appropriately resampled | to a lat / long system | GEOPSB + GEOLOB | no | Orthorectified image, orthophoto |
| 2 | | to a cartographic grid (eg. UTM or MGRS) system | GEOPSB + MAPLOB + PRJPSB | no | |
| 3 | | elevation model available | RPC00x + elevation model + ICHIPB if chipped | no | |
| 4 | Imagery can not be rectified / resampled, but sensor model can be computed | elevation model available | GEOPSB + GRDPSB + PRJPSB [1] or GEOPSB + REGPTB [2] | no | Unambiguously georeferenced image |
| 5 | | elevation model not available | RPC00x and ICHIPB if chipped | no | Georeferencable image [3] |
| 6 | Sensor model data is available and can be delivered, but sensor model cannot or intentionally shall not be computed during image production | this is equivalent to the situation, that full exterior and interior orientation of the sensor is known. | For TREs supporting sensor models (see below under Case no. 6) | **generally yes** [4] | Georeferencable image [5] |
| 7 | Sensor model data is available only | corner coordinates suffice | IGEOLOB + ICORDSB fields of image subheader | no | Non-georeferencable image with |

| Case | Capabilities at image production site or at platform | | Instrument to provide geolocation information | Additional assumptions necessary | Product to be delivered |
|---|---|---|---|---|---|
| | partly or with moderate accuracy | other coordinates (e.g. image center or target location) shall be provided | Appropriate SDEs can be found from the catalogue of NSIF approved SDEs. 6) | no | geolocation information for corner pixels or for other points of interest |

1) This combination is appropriate if a regularly spaced grid should be delivered with the image.
2) This combination is appropriate if a limited or irregularly spaced number of registration points should be delivered with the image.
3) The image can be precisely georeferenced if (and only if) an elevation model is available at the receiving site.
4) At present time, no SDE from the catalogue of the Airborne SDEs can carry the full interior orientation of an optical imaging sensor.
5) The image can be precisely georeferenced if the additional assumptions are known at the receiving site and an elevation model is available at the receiving site.
6) From these, GEOPSB + SNSPSB offer greatest flexibility.

In a large number of applications, the cases no. 6 and 7 characterize the situation at hand. These cases need further comments:

**Case no. 6:**

Here, the full interior and exterior sensor orientation must be transmitted within the NSIF file:

For a full interior orientation the following data are necessary:
(1) Focal length
(2) Pixel coordinates of the point where the optical axis intersects the pixel matrix (this is not necessarily the image center)
(3) Geometric distortion characteristics of the lens system, at least its projection equation

And the exterior orientation comprises the following data:
(4) Geodetic position of the projection center of the sensor ("sensor position")
(5) Direction of the optical axis, usually given by three rotational angles within the local NED system
(6) Sequence order of the rotational angles

The SENSRB SDE can accommodate such data. (It supplies rotational angles both for the sensor and the platform to allow a two-step transformation from the sensor system into the NED system.)
The data for (1) can be accommodated for in the ACFTB or BANDSB SDE.
However, the data for (2) can be stored only in the MENSRB or MPDSRA SDEs (in the form of row and column numbers, and at the price of considerable overhead), and the data for (3) and (6) cannot be stored at all within the present inventory of NSIF SDEs.

In this respect, the situation for case no. 6 is that:

- one has to assume that the sensor is free of distortion (e.g. its projection strictly follows a tangent law, it is not in any way equidistant, orthographic, or similar.)
- one has to assume the image center (center of the pixel matrix of the image segment) is identical to the point, where the optical axis had intersected the focal plane. (unless one uses MENSRB or MPDSRA)
- one has to agree on a certain angle sequence order for the two transformations by which the optical vector is transformed into the local NED system.

**Case no. 7**:

The IGEOLO and ICORDS fields of the image subheader, as well as the numerically more precise BLOCKA SDE generally do not provide enough information for georeferencing. The sole existence of these data within an NSIF file does not justify any conclusion regarding the geometric properties or the rectification status of the pixel matrix.

Special points of interest, e.g. target coordinates, may be given within various SDEs. Their possibilities vary regarding accuracy, geodetic datum, coordinate system, and two- or three-dimensional coordinate representation.

The following 3 lists of SDEs (Airborne, DIGEST and Commercial) are not exclusive and may be combined or supplemented with other SDEs.

The following SDEs provide such capabilities for specifying points and/or regions of interest. They may be found in the STDI-0002 document:

- ACFTB
- AIMIDB
- BLOCKA
- CMETA§
- ICHIPB
- MENSRB
- MPDSRB
- MSTGTA
- PATCHB
- RPC00B
- SENSRB
- STDIDC

(§ - Deprecated: Do not use for new products or systems)

The following SDEs provide such capabilities. They may be found in the DIGEST documentation:

- BNDPLB
- GEOLOB
- GEOPSB
- GRDPSB
- MAPLOB
- PRJPSB

- REGPTB
- REGPTC
- SNSPSB

The following SDEs provide such capabilities. They may be found in the Commercial Support Data Extensions (Com SDE STDI-0006) documentation:

- CSCCGA
- CSCRNA
- CSEPHA

20. Chipping images with BLOCKA TRE

When an image is chipped either the original geolocation source information (e.g., BLOCKA, RPC00B, CSCRNA, etc.) must be changed to reflect the new geolocation information or an ICHIPB TRE must be added to allow the user to understand the new data parameters. If an ICHIPB already exists (i.e., the image was previously chipped) then it must be modified for the new chip.

For example, when a BLOCKA TRE image source is chipped the user has two choices. Either the user can use the original BLOCKA with an ICHIPB TRE and then modify the IGEOLO fields or the user can modify the BLOCKA and IGEOLO to match the chip and then no ICHIPB is required. The user can either recalculate the BLOCKA TRE or add an ICHIPB TRE retaining the original BLOCKA. If the user is processing a product that has an ICHIPB TRE, it must have the original BLOCKA TRE. In this case the IGEOLO and BLOCKA "will not match". A processor can either use the IGEOLO or the BLOCKA if no ICHIPB TRE is present, or if an ICHIPB is present, use the IGEOLO or calculate the corner points using the ICHIPB as it relates to the original image coordinates as presented in the BLOCKA, but not the BLOCKA directly.

21. Originating Station Identification Field (OSTAID).

The Originating Station ID is a required alphanumeric field in the NSIF file header that contains the identification code or name of the organization, system, station, or product. This field may not contain all BCS-A spaces (0x20). Generally, the user can set this field either at file creation time or through some default (header) setting depending on the CONOPS.

22. Originator's Name and Phone Number (ONAME, OPHONE)

Historically the use of the ONAME and OPHONE fields has varied from system to system. In some cases, direct operator action must/may be taken to populate these fields, while some systems may provide default values that can be changed by the operator. The use of these fields should be considered by the CONOPS at all points/times in the lifecycle of an NSIF file. It is difficult to establish steadfast rules as it may not be possible in an evolving imagery architecture to assume a file will be confined to a particular user community. Given that, an operator's name and phone are essentially “perishable” information. The following is a general guideline on how particular systems are populating these fields:

Producer: Imagery sources populate with general source if classification level allows it.

NOTE: There are TREs where sensors/producers provide origination type information.

Dissemination Point; i.e., ground station: Imagery simply passing through a ground system would not alter the information as it comes from the producer.

Exploitation Workstation: Probably the first point of replacing the value where the primary analyst should apply the information.

Follow-on exploitation: When further exploitation is made, the analyst should update the ONAME and OPHONE with their information.

Archiving: Upon ingest into and export out of an image library, the fields should retain the incoming information.

23. Date and Time Fields (FDT, IDATIM, TXTDT).

23.1 The File Date and Time (FDT) field contains the UTC time (Zulu) of the origination (time of generation) of the file. The value in this field is updated each time the file is modified, updated or changed (e.g., adding or removing segment data) and saved.

23.2 The Image Date and Time (IDATIM) field contains the date and time of the image acquisition. Once populated, the content of this field is never changed. The importance of this field is often over-looked or misunderstood. Image analysts often compare images of a given area to determine changes over time. If the IDATIM is changed to anything other than the actual acquisition time, it is obvious what kind of problem that could create. Libraries use this field to catalogue an image for discovery and retrieval by users, so again, it is important that it maintain the actual acquisition date and time.

23.3 The Text Date and Time (TXTDT) field contains the time of the text origination. The field value is updated any time the text content is modified and saved.

23.4 Hyphens (hexadecimal code “2D”) are used for unknown components of the date and time field. It should be noted that there may be legacy systems that used unique methods for handling the generation of date and time information prior to this official process being approved. Populate the unknown date/time two character subfield with two hyphen-minus characters indicating the portion of the date or time that is unknown. For example, populating a date and time field when the Century (CC), Year (YY), Month (MM), and Day (DD) are known, but the hour (hh), minute (mm), and second (ss) values are unknown, appears as: 20020425------. In another example such as a birthday of 14 Feb 47, where the CC is unknown or not expressed by the source of the information, the value would appear as: --470214. If the entire date is unknown the field should be filled with hyphens.

24. File Background Color (FBKGC).

The NSIF File Background Color defines the background color behind displayable segments. This field deviates from the BIIF standard, ISO/IEC 12087-5. The ISO community accepted this deviation from the standard when the NSIF profile was submitted.

The concept of file background color was introduced with the legacy MIL-STD 2500 and the initial discussions to create STANAG 4545. An interoperability problem was discovered in the field when the receiver's default background color (color of the "canvas area" established by the extent of the Common Coordinate System) was different from the originator's background color. This mismatch created the potential for the originator's symbol/text annotations to not be visible on the receiver's screen. To allow the designation of FBKGC without disrupting the integrity of the format, the first three bytes of the ONAME field were redesignated as the FBKGC field for use in specifying the file background color. The values placed in the FBKGC field are to be interpreted as three 8-bit binary RGB values in Red, Green, and Blue order. The use of the FBKGC field continues in STANAG 4545 Edition 2. Per the ISO BIIF standard, the fields within the NSIF headers are constrained to be UTF-8 encoded characters. Unfortunately, the use of the binary RGB value in the FBKGC field deviates from this constraint of the ISO standard, realized after a large number of systems had already implemented the feature. Consequently, STANAG 4545 Edition 2 will continue to use the FBKGC field as currently specified while acknowledging the minor deviation from the BIIF standard. Implementers are cautioned that values placed in this field may adversely disrupt the logical sequence of a UTF-8 encoded text stream if/when attempting to read this field as a character field. Implementers need to be aware of the dual use of the FBKGC/ONAME field in files due to the possibility of ISO/IEC Standard 12087-5:BIIF compliant files not having a FBKGC value in the first three characters of what was the ONAME field.

25. Image Representation

The IREP field provides information to indicate how the image data is to be represented. For example, an image where each pixel is represented based on a Red, Green, and Blue color value would be RGB. This field should be used in conjunction with the ICAT, ISUBCAT and IREPBAND fields to interpret the significance of each band in the image.

A special case of the use of IREP is when the sensor produces imagery using the classic false-color convention. In this case, three bands, green, red, and near-infrared, are collected. The intent is to shift the bands for display. The green band is displayed on the blue gun, the red band is displayed on the green gun, and the near-infrared band is displayed on the red gun. This provides an image tailored to show camouflage and other man-made objects. It is recommended that when producing these files, the IREPBANDn value for each band be used to indicate the desired display band, R, G, and B. Thus, standard electronic light table programs will display the image accurately without special operator interaction. It is recommended that the ICAT and ISUBCATn fields be used to reflect the actual nature of the bands by using MS for ICAT and the proper wavelength shown for each ISUBCATn field. The IREP field should reflect MULTI. In addition, the BANDSB tagged record extension can be included to reflect the wavelength information for each band.

26. Image Category and Product Discovery Attributes

The intent of the ICAT field in the image subheader is to provide a general category of the image segment. For example, a Synthetic Aperture Radar would have an ICAT of SAR and a Raster Map would have an ICAT of MAP. Generally, this field is not intended for use in making processing decisions regarding the image segment. Processing information needed by a system can be found in the other image subheader fields. This field can be useful for discovery and retrieval for image archives. (i.e., A user may want to retrieve all the SAR images tied to a geographical area.)

27. Image and Data Compression

27.1 Over the years the NSIF community has incorporated the use of various image compression algorithms to facilitate different operational requirements. The types of image compression supported within NSIF are listed below. The current primary compression method in use is JPEG 2000. JPEG 2000 provides a significant increase in capability over previous compression methods and is the preferred method of compression. As legacy compression types are phased out, additional phase-out guidance will be issued by the 4545 CST for future implementations.

27.2 JPEG Lossy and Lossless compression. The legacy form of JPEG (DCT and Lossless) (MIL-STD-188-198A) used for continuous tone types of imagery such as photographic images. It is expected that systems will have to continue to interpret legacy JPEG for an indeterminate time into the future. Some libraries may offer conversion services for migrating legacy JPEG to JPEG 2000.

27.3 Vector Quantization. This compression is used primarily by US NGA to compress maps into the Compressed ARC Digitized Raster Map (CADRG) product. For this reason, NSIF applications are only required to decompress and display VQ compressed NSIF image segments. This compression method was mostly used by NITF 2.0 (Mil-Std-2500A with change notices 1 through 3).

27.4 Bi-Level or Facsimile compression. This compression algorithm is used for two color images of one bit-per-pixel and complies with the category 3 Facsimile standard to allow for interoperability with facsimile images. The actual use of Bi-Level compression has been very limited and, therefore, it is recommended that Bi-level decompression no longer be required based on the Concept of Operations of the system. This compression method was mostly used with NITF 2.0 (Mil-Std-2500A with change notices 1 through 3) formatted files.

27.5 JPEG 2000 (J2K). Within the last few years a new version of JPEG, called JPEG 2000 (J2K) emerged (ISO/IEC 15444-1 and 15444-2). J2K uses much improved methods of repackaging compressed data (wavelet compression) that enables significant improvements in its utility. NSIF incorporates the use of J2K, and has developed a BIIF profile of JPEG 2000 compression (BPJ2K01.10).

Note: While it is outside of the scope of this document to make specific software recommendations, in the interest of supporting low-risk investment and interoperability between nations, it is noted that many of the national operational systems use the Kakadu software to read and write their JPEG 2000 images.

NSIF 1.0, NSIF 1.01, and NITF 2.1 have basic provisions for containing imagery that has been compressed using JPEG 2000 techniques. The image segment subheader Image Compression (IC) field in these standards has identified parameter values of C8 (without preceding data mask tables) and M8 (with preceding data mask tables) to signal that the image data is JPEG 2000 compressed. However, these standards are otherwise silent as to the relationship of other sub-header field parameter and range choices when the image data is JPEG 2000 compressed. This section reviews the use of image subheader fields and provides guidelines for populating these field values when using JPEG 2000 compression.

Within NSIF, JPEG 2000 will comply with the requirements of both ISO/IEC 15444-1 and BPJ2K01.10. The basic philosophy of the implementation of JPEG 2000 is discussed in Section 9 of BPJ2K01.10.

27.5.1 Blocking / Tiling Image Segments. Prior to the development of JPEG 2000, the JPEG standard did not address blocking and/or tiling of the image data internal to the compressed data stream. The BIIF standard uses the term “blocking” whereas the JPEG 2000 standard uses the term “tiling” to describe the concept of organizing a data array into a set of smaller sub-arrays. The NSIF/NITF/BIIF specification allows for blocking/tiling of the image data, both when compressed and uncompressed. There are some communities that refer to image blocks and/or tiles as Fast Access Format (FAF) blocks or "FAFs". They use this fundamental concept to be identical among the alternative terminology, although originally FAF blocks were a fixed size of 1KB rows and a fixed number of columns.

To cope with the lack of blocking/tiling support within the earlier version of JPEG, NSIF/NITF/BIIF treats each block/tile sub-array separately for purposes of compression. That is, each sub-array is individually compressed into a JPEG data stream. Each JPEG data stream is then placed, one after the other, in the Image Segment data area. The image subheader fields that describe the geometry of the blocks/tiles are used in conjunction with the interleave marker field (IMODE) to describe the sequence of the data streams and the interleave of bands/components within and among the individual JPEG data streams.

Now that JPEG 2000 supports blocking/tiling within the compressed data stream, NSIF/NITF/BIIF should take advantage of this new capability. JPEG 2000 also brings with it a whole new concept and means for interleaving the compressed data when compared to the traditional pixel, row, tile, band interleave options commonly used in uncompressed pixel arrays. At a high level of abstraction, JPEG 2000 provides a variety of progression sequence ordering of "tile-parts" that contribute to the overall reconstruction/presentation of the image.

For application of JPEG 2000 in NSIF/NITF/BIIF, use the IMODE value of "B" to indicate that both the blocking/tiling and interleave (tile-part progression order) is as expressed within the single compressed data stream contained in the Image Segment data field. Values in the image subheader fields that describe the size/geometry of the pixel array will be populated with values that represent the maximum attributes of the array geometry that can be extracted from the compressed data stream. The setting of the IMODE value in this way is for discovery purposes only.

Modes for interleave by pixel (IMODE=P), interleaved sequential (IMODE=S) and interleave by row (IMODE=R) are not applicable once the data is transformed into a JPEG 2000 compressed data stream.

27.6 Image Segment Size Considerations. There are several fields in the NSIF/NITF/BIIF file header and image subheaders that must be mutually considered in regards to the overall size of the data that may be contained within a single Image Segment data field. The following discussion is intended to offer some perspective on the interrelationships among these fields.

<u>File Length (FH: FL).</u> The BIIF header has a field (FL) that contains the length, in 8-bit bytes, of the entire BIIF file. The FL field is defined as N/12 (i.e., numeric 12 bytes long), allowing file lengths up to 999,999,999,998 bytes (all 9s in this field is reserved as a special condition flag value).

<u>Image Segment Data Field Length (FH: LIn)</u>. The BIIF header has fields (LIn) to express the number of 8-bit bytes for each image array in the BIIF file. The LIn field is defined as N/10 (numeric 10 bytes long), allowing up to 9,999,999,998 bytes of image data per image segment (all 9s in this field is reserved as a special condition flag value). A single Image Segment can therefore carry nearly 10 Gbytes of image data. If the image data is compressed, an Image Segment may contain data representing an image, that when uncompressed, is too large to be saved/stored in its uncompressed state within a single Image Segment.

<u>Image Array Size (IM: NROWS/NCOLS)</u>. The vertical and horizontal dimensions of the image array are defined by the NROWS/NCOLS fields of the image subheader. Both the NROWS and NCOLS

fields are defined as N/8 (numeric 8 bytes long), allowing vertical and horizontal dimensions of the array up to 99,999,998 storage cells in each direction. The effective byte size of each storage cell is determined by the number of bits per pixel per band (NBPP field) and the number of bands (NBANDS/XBANDS field). Values selected for blocking/tiling may impose a constraint on the maximum values that can be used for NROWS/NCOLS. NSIF/NITF CLEVEL 07 allows the maximum BIIF range for NROWS/NCOLS.

Example 1. For a typical blocking/tile size of 1024 (1K), a single-band, 8-bit-per-pixel image array of 97 blocks/tiles in both the vertical and horizontal directions would have statistics as follows:

NROWS = 97 x 1024 = 99,328 bytes (97K)
NCOLS = 97 x 1024 = 99,328 bytes (97K)
LI = 97K x 97K x 1 byte x 1 band = 9,866,051,584 bytes (CLEVEL 07)

Example 2. For an image array with blocking/tile size of 1024, single-band, but with16-bits-per-pixel; an uncompressed 97K x 97K image array is too large and one or both of the vertical and horizontal dimensions must be reduced to keep the total array length within bounds. For example:

LI = 97K x 49K x 2 bytes x 1 band = 9,967,763,456 bytes (CLEVEL 07)
LI = 64K x 64K x 2 bytes x 1 band = 8,589,934,592 bytes (CLEVEL 06).
Note: This image will fit if it is compressed below 9,999,999,998 bytes.

Note that for a single image product the CCS maximum grid size is also constrained to the maximum NROW/NCOL dimensions allowed for an individual Image Segment. For a multi-image product the CCS maximum may be increased by using the ILOC/SLOC with attachment levels, IALVL/SALVL When considering how to organize image data within a BIIF file, due consideration should be given to the resulting file size, and the available storage and exchange media capabilities for containing and addressing large files.

27.7 Mosaic of Multiple Image Segments in a Single BIIF File. As shown by the sample calculations of array sizes in the previous paragraph, if the dimensions of a digital image collection are very large, the data from the collected image array will need to be organized into a “mosaic” of multiple Image Segments. These Image Segments can be configured one segment per BIIF file as done for Controlled Image Base (CIB) and Digital Point Positioning Data Base (DPPDB) products, or as multiple Image Segments within a single BIIF file as done for several Airborne products. This paragraph is focused on the single file approach, please refer to CIB and/or DPPDB specifications for descriptions of possible multi-file approaches.

In the single-file approach, the Image Location (ILOC) field in the image subheader is used to mutually position image segments relative to each other. This is done by assuming a common reference grid called Common Coordinate System (CCS) wherein the ILOC value gives the row/col value for the first pixel of each image segment pixel array. The ILOC value of any given Image Segment is relative to either the origin (0,0) of the CCS (unattached), or relative to the first pixel of the Image Segment to which it is attached (see the IALVL field).

The ILOC field allows for row offsets of up to 99,999 rows and column offsets of up to 99,999 columns. This places a maximum row/col size limitation for each Image Segment within the mosaic of Image Segments in the BIIF file. At first impression, this limitation seems like it would be too restrictive. However, as shown in the above paragraph about Image Segment size considerations, the total array maximum byte size (~10Gbytes) is often the limiting factor for arrays with dimensions less than 99,999 x

99,999, unless the IALVL field is used. For long/thin or short/wide image arrays (vertical or horizontal strip arrays), the mutual constraints for maximum image size and ILOC are adequate to allow cascading offsets of Image Segments in either the vertical or horizontal direction as appropriate. This option results in a single (or few) row(s) of image segments or single (or few) column(s) of image segments within a BIIF file.

When the total image data size of the imaging operation that is to be placed in a single BIIF file exceeds the maximum LI constraint (~10Gbyte), the data shall be organized using multiple Image segments. Each Image segment shall be constrained such that either NROWS or NCOLS (or both) have a value less than 99,998. The overall mosaic may be made larger than 99,998 rows x 99,998 columns by attaching each additional segment, via the ILOC and IALVL fields, to the preceding image segment. This allows each additional image segment to add 99,998 rows and/or columns to the mosaic. This will allow a mosaic of Image Segments to be expressly established within the BIIF CCS reference grid.

27.8 JPEG 2000 and the Mosaic Approach. When considering the mosaic approach described above, some guidance for applying JPEG 2000 compression is in order. Whenever possible, the entire imaging operation pixel array should be JPEG 2000 compressed as a single tiled image array prior to partitioning into image segments. The compressed array should then be partitioned (chipped) along tile boundaries for placement in the separate Image Segments of the mosaic thus retaining the original row (Y), column (X) and tile indices from the compressed stream of the full imaging operation. This approach will allow an explicit association of original line/sample (row/col) from the original imaging operation. This is often very useful when correlating pixel values with imaging exploitation support data.

NOTE: for multispectral images to be truly numerically lossless, it is necessary to compress each component separately.

28. Recommended NSIF Reader Capabilities.

During interoperability demonstrations, it became clear that certain functional capabilities were desirable of all NSIF file readers (unpack/process/display operations). These functionalities are not mandatory and each software developer can tailor their product to meet the specific requirements of their customer. However, when developing general purpose software to unpack and display NSIF image files, these features are recommended.

28.1 Ensure that the software application easily accepts text only messages and NSIF text segment only data. Most military reports issued by NATO nations are text based and a restriction in the ability to handle text-only data would severely limit the military utility of these software packages. It would also be advantageous to have geo-located text reports. This feature would allow text reports to be entered in an imagery library that could be searched using a geographical search tool, such as a highlighting an area on a map. This feature proved very useful during Phase II of the demonstration where the images and reports were loaded onto an IPL. Similarly, the application should be capable of displaying multiple text segments and inform the operator of the availability of all textual information available.

28.2 All software packages should be able to easily display multiple image segments. In some current applications, the operator is not even aware that the file contained multiple image segments. The application should provide an overview that includes all images and/or a menu that highlights that multiple image segments are present. Consideration should be given to ensure that the operator is aware of the multiple image segments, even if one image obscures others due to the relative positioning on the common coordinate system. Displaying the imagery should also be a simple operation.

28.3 With all image segments in the file, the operator should be able to view geolocation information (i.e. the cursor indicator should give a Lat/Long readout) when geolocation information is available. This geolocation is an indication of where the image is on the surface of the earth and is very important to the military operator. While pixel X-Y locations are of interest in some cases, the conversion to the latitude and longitude are very important. It should also be noted that these conversions should be based on the data contained in the appropriate tagged record extension (and not IGEOLO – see paragraph 19, above). The source of the calculations should also be readily available to the operator (providing an understanding of the accuracy of the information provided).

28.4 With the increasing interest in multispectral (multiband) imagery, it is recommended that the applications be capable of at least limited multispectral imagery processing. The operator should be provided with the list of the number of bands and be allowed to select which one (for displaying the band as monochrome) or ones (for displaying 3-bands as color red, green and blue (RGB)) to display. In cases where three bands are previously labeled or marked for display red, green, and blue (regardless of order of placement in the bands, those bands identified for display has precedence over those not marked for display), they should be the default display bands.

28.5 The complexity level (CLEVEL) field allows the NSIF file to be implemented on a wide range of hardware platforms with various levels of internal resources while maintaining a baseline level of interoperability between all compliance tested systems. Applications/systems generating NITFS files shall mark them at the lowest CLEVEL for which they qualify.The CLEVEL should be used to indicate the required imagery processing needed to display the image within the file, not as a limiting factor of the reader. Some files will be shown as a higher complexity level because of only one attribute. Readers should not read the complexity level and use it as a "go-no go" processing function. The reader should indicate to the user, through a warning message, that the file may exceed the capabilities of the reader and then proceed to read and display as much of the file as possible and identify to the operator which feature(s) were not supported.

28.6 Similarly, the application should identify which support data extensions are included in the file, even if the application does not support the use of the extension. The standardisation agreement requires that unsupported extensions should be recognized and skipped. The recommendation is that the reader be able to syntactically recognize the unused extension, pulling out the extension name and size for cataloging to the operator. An additional capability would be for the operator to be able to select and view the field values of each extension.

28.7 File editors should be included that are easy to use to write and extract NSIF file data. As changes are made to the file, certain header and subheader field values need to be updated. In cases where the fields are not automatically updated, the operator should be able to easily edit the fields to make the necessary changes.

28.8 It is recommended that packages that have both pack (write) and unpack (read) capabilities be capable of unpacking all files that the package can pack. A broader level of desired capability is for the package to unpack all files of the same level as those that it can pack. However, this latter capability may be an excessive burden. If the pack capability is defined at a high level due to a single parameter in the packed file, the ability to unpack all files at the high CLEVEL may be beyond the capability of the reader. While this higher level of capability is desirable, the basic recommendation is to have the reader be capable of reading any file it can pack.

28.9 Experience in the field has noted that with some applications, if a file is opened and then immediately saved under a different name, the dates in the file are changed. It is recommended that if applications are capable of saving open files, that they either do not change the date fields in the file, or give the operator the option of keeping the original dates or updating the dates with current date and time. This will preclude automatic updates when the files are a renamed copy of the original.

## 29. Product Identification and File Naming

Within the NSIF community there are various conventions practiced for file naming and product identification. It is important that, within communities of users, these conventions are known and dealt with accordingly as they often add increased usability to imaging operations. AEDP-2, Volume 3, Annex B provides additional information.

## 30. Use of Real, Signed Integer or Complex Data In Non-Displayable Image Segments For Display Purposes.

30.1 Given that Image Segments may contain non-displayable data, the following guidelines are provided for the proper interpretation and display. Since no individual PVTYPEs are possible for each band, once selected, a PVTYPE must be applicable to all bands present in an image. As long as only one band needs to contain negative values, PVTYPE must be expanded to a type that allows negatives as well. At the same time IREP=POLAR seems a natural choice for advanced SAR imagery data that provide both magnitude and phase or an equivalent representation, e.g. inphase and quadrature, for each pixel. IREP=POLAR is allowed for 2 band SAR and SARIQ (see ISO/IEC BIIF Profile NSIF01.01 Table D-1). Negative values can be assigned to meaningful values for display purposes.

30.2 Vector data, e.g. processed SAR inphase and quadrature data, that per se can provide both negative and positive valued components in each band, should be displayed such, that the maximum negative value of the data type is displayed as black and the maximum positive value of the SI data type as white. The value zero is displayed as an intermediate grey level.

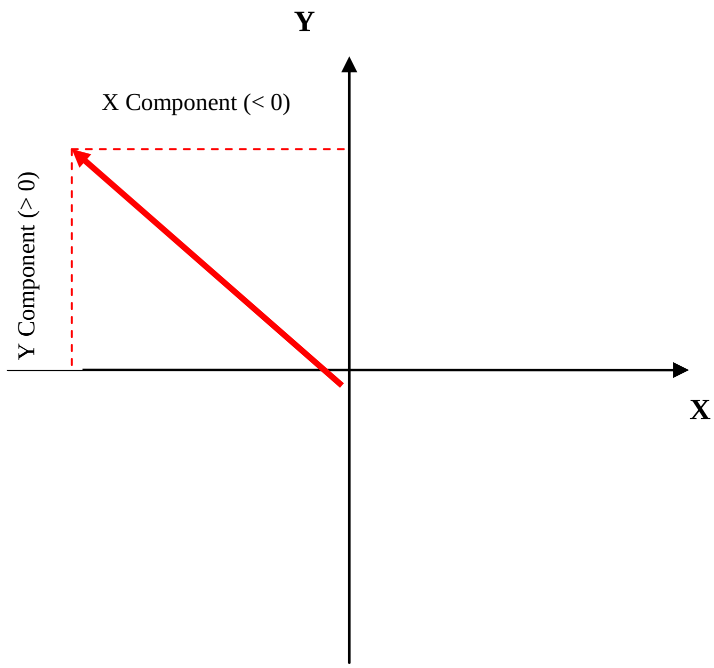


**Figure A-6. Vectors**

30.3 Bands that contain magnitude data are limited in their pixel values by definition to positive integers. The negative range of signed integers is not utilized in this case. Magnitude data can therefore be displayed as usual with black corresponding to a magnitude of zero and white to the maximum positive integer allowed for the chosen signed integer size.

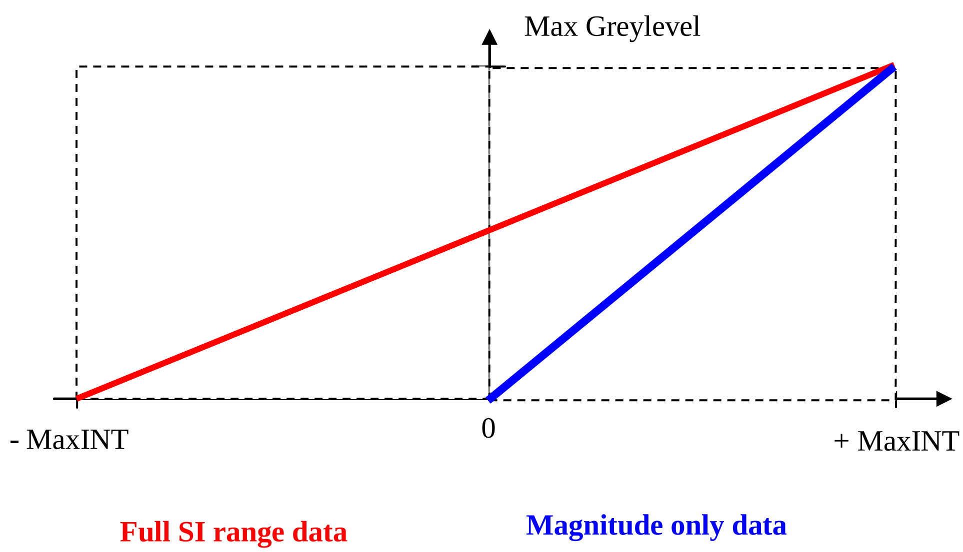


**Figure A-7. Mapping SI to Grey Level**

30.4 For display purposes, bands that contain angular values, e.g. from $-\pi$ to $+\pi$, shall be mapped to the signed integer range such that the maximum negative value corresponds to $-\pi$ and the maximum positive value to +π. Again, the maximum negative value is displayed as black and the maximum positive value as white.

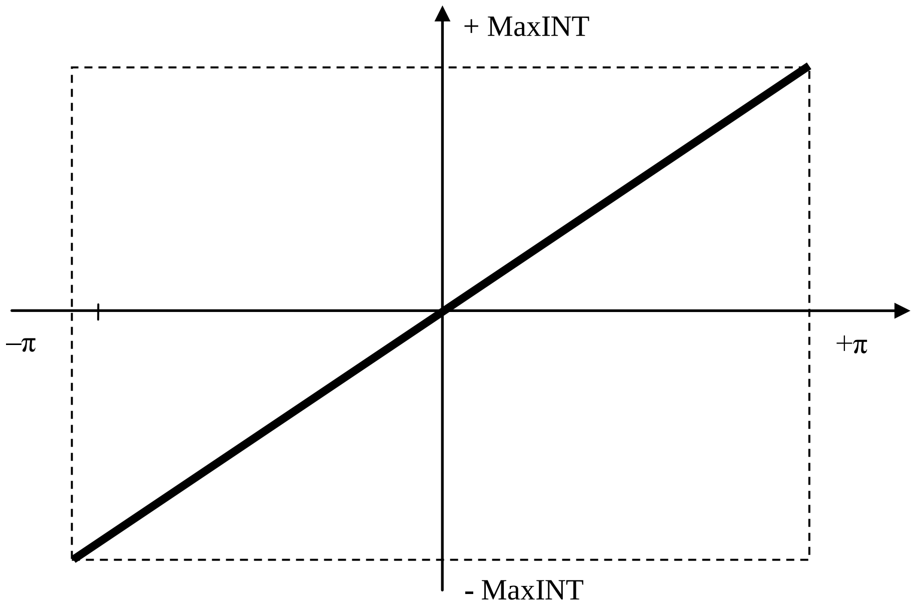


**Figure A-8. Angular Mapping**

30.5 In conclusion, the following common solutions to display SI data are recommended:

- NODISPLAY
  Content is not intended for display. Each band may contain SI
- NVECTOR
  Each band may contain a SI vector component
- MULTI
  Each band may contain a SI vector component or SI magnitude data. For magnitude values, only the positive SI range is utilized
- POLAR
  In case of IQ-data, each band may contain an I, SI or R vector component. In case of MP-data, each band may contain SI, R or C data. For magnitudes, only the positive SI range is utilized SI is utilized for the phase and magnitude because the two bands need to be the same type (e.g., SI).
- VPH
  In case of IQ-data, each band may contain a SI vector component. In case of MP-data both bands may contain SI data. For magnitudes, only the positive SI range is utilized.

30.6 For display purposes, bands that contain real (floating point) values, e.g. from –∞ to +∞ (within the range of the IEEE storage format), shall be mapped to the signed integer range such that the maximum negative value corresponds to –∞ and the maximum positive value to +∞. Again, the maximum negative value is displayed as black and the maximum positive value as white.

# Table A-3. NSIF 1-Byte Coded Characters

| | Table A-3 NSIF 1-Byte Coded Characters | Code | | | Character Set | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|
| Char | Name | Dec | Hex | Binary | U8S | ECS | ECS-A | BCS | BCS-A | BCS-N | BCS-N Integer | BCS-N Positive Integers |
| | NOT USED | 000 | 00 | 0000 0000 | | | | | | | | |
| | NOT USED | 001 | 01 | 0000 0001 | | | | | | | | |
| | NOT USED | 002 | 02 | 0000 0010 | | | | | | | | |
| | NOT USED | 003 | 03 | 0000 0011 | | | | | | | | |
| | NOT USED | 004 | 04 | 0000 0100 | | | | | | | | |
| | NOT USED | 005 | 05 | 0000 0101 | | | | | | | | |
| | NOT USED | 006 | 06 | 0000 0110 | | | | | | | | |
| | NOT USED | 007 | 07 | 0000 0111 | | | | | | | | |
| | NOT USED | 008 | 08 | 0000 1000 | | | | | | | | |
| | NOT USED | 009 | 09 | 0000 1001 | | | | | | | | |
| | LINE FEED | 010 | 0A | 0000 1010 | X | X | | X | | | | |
| | NOT USED | 011 | 0B | 0000 1011 | | | | | | | | |
| | FORM FEED | 012 | 0C | 0000 1100 | X | X | | X | | | | |
| | CARRIAGE RETURN | 013 | 0D | 0000 1101 | X | X | | X | | | | |
| | NOT USED | 014 | 0E | 0000 1110 | | | | | | | | |
| | NOT USED | 015 | 0F | 0000 1111 | | | | | | | | |
| | NOT USED | 016 | 10 | 0001 0000 | | | | | | | | |
| | NOT USED | 017 | 11 | 0001 0001 | | | | | | | | |
| | NOT USED | 018 | 12 | 0001 0010 | | | | | | | | |
| | NOT USED | 019 | 13 | 0001 0011 | | | | | | | | |
| | NOT USED | 020 | 14 | 0001 0100 | | | | | | | | |
| | NOT USED | 021 | 15 | 0001 0101 | | | | | | | | |
| | NOT USED | 022 | 16 | 0001 0110 | | | | | | | | |
| | NOT USED | 023 | 17 | 0001 0111 | | | | | | | | |
| | NOT USED | 024 | 18 | 0001 1000 | | | | | | | | |
| | NOT USED | 025 | 19 | 0001 1001 | | | | | | | | |
| | NOT USED | 026 | 1A | 0001 1010 | | | | | | | | |
| | NOT USED | 027 | 1B | 0001 1011 | | | | | | | | |
| | NOT USED | 028 | 1C | 0001 1100 | | | | | | | | |
| | NOT USED | 029 | 1D | 0001 1101 | | | | | | | | |
| | NOT USED | 030 | 1E | 0001 1110 | | | | | | | | |
| | NOT USED | 031 | 1F | 0001 1111 | | | | | | | | |

| | Table A-3 NSIF 1-Byte Coded Characters | Code | | | Character Set | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|
| Char | Name | Dec | Hex | Binary | U8S | ECS | ECS-A | BCS | BCS-A | BCS-N | BCS-N Integer | BCS-N Positive Integers |
| | SPACE | 032 | 20 | 0010 0000 | X | X | X | X | X | | | |
| ! | EXCLAMATION MARK | 033 | 21 | 0010 0001 | X | X | X | X | X | | | |
| " | QUOTATION MARK | 034 | 22 | 0010 0010 | X | X | X | X | X | | | |
| # | NUMBER SIGN | 035 | 23 | 0010 0011 | X | X | X | X | X | | | |
| $ | DOLLAR SIGN | 036 | 24 | 0010 0100 | X | X | X | X | X | | | |
| % | PERCENT SIGN | 037 | 25 | 0010 0101 | X | X | X | X | X | | | |
| & | AMPERSAND | 038 | 26 | 0010 0110 | X | X | X | X | X | | | |
| ' | APOSTROPHE | 039 | 27 | 0010 0111 | X | X | X | X | X | | | |
| ( | LEFT PARENTHESIS | 040 | 28 | 0010 1000 | X | X | X | X | X | | | |
| ) | RIGHT PARENTHESIS | 041 | 29 | 0010 1001 | X | X | X | X | X | | | |
| * | ASTERISK | 042 | 2A | 0010 1010 | X | X | X | X | X | | | |
| + | PLUS SIGN | 043 | 2B | 0010 1011 | X | X | X | X | X | X | X | |
| , | COMMA | 044 | 2C | 0010 1100 | X | X | X | X | X | | | |
| - | HYPHEN-MINUS | 045 | 2D | 0010 1101 | X | X | X | X | X | X | X | |
| . | FULL STOP | 046 | 2E | 0010 1110 | X | X | X | X | X | X | | |
| / | SOLIDUS | 047 | 2F | 0010 1111 | X | X | X | X | X | X | | |
| 0 | DIGIT ZERO | 048 | 30 | 0011 0000 | X | X | X | X | X | X | X | X |
| 1 | DIGIT ONE | 049 | 31 | 0011 0001 | X | X | X | X | X | X | X | X |
| 2 | DIGIT TWO | 050 | 32 | 0011 0010 | X | X | X | X | X | X | X | X |
| 3 | DIGIT THREE | 051 | 33 | 0011 0011 | X | X | X | X | X | X | X | X |
| 4 | DIGIT FOUR | 052 | 34 | 0011 0100 | X | X | X | X | X | X | X | X |
| 5 | DIGIT FIVE | 053 | 35 | 0011 0101 | X | X | X | X | X | X | X | X |
| 6 | DIGIT SIX | 054 | 36 | 0011 0110 | X | X | X | X | X | X | X | X |
| 7 | DIGIT SEVEN | 055 | 37 | 0011 0111 | X | X | X | X | X | X | X | X |
| 8 | DIGIT EIGHT | 056 | 38 | 0011 1000 | X | X | X | X | X | X | X | X |
| 9 | DIGIT NINE | 057 | 39 | 0011 1001 | X | X | X | X | X | X | X | X |
| : | COLON | 058 | 3A | 0011 1010 | X | X | X | X | X | | | |
| ; | SEMICOLON | 059 | 3B | 0011 1011 | X | X | X | X | X | | | |
| < | LESS-THAN SIGN | 060 | 3C | 0011 1100 | X | X | X | X | X | | | |
| = | EQUALS SIGN | 061 | 3D | 0011 1101 | X | X | X | X | X | | | |
| > | GREATER-THAN SIGN | 062 | 3E | 0011 1110 | X | X | X | X | X | | | |
| ? | QUESTION MARK | 063 | 3F | 0011 1111 | X | X | X | X | X | | | |
| @ | COMMERCIAL AT | 064 | 40 | 0100 0000 | X | X | X | X | X | | | |
| A | LATIN CAPITAL LETTER A | 065 | 41 | 0100 0001 | X | X | X | X | X | | | |

Table A-3 NSIF 1-Byte Coded Characters

| | | Code | | | Character Set | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|
| Char | Name | Dec | Hex | Binary | U8S | ECS | ECS-A | BCS | BCS-A | BCS-N | BCS-N Integer | BCS-N Positive Integers |
| B | LATIN CAPITAL LETTER B | 066 | 42 | 0100 0010 | X | X | X | X | X | | | |
| C | LATIN CAPITAL LETTER C | 067 | 43 | 0100 0011 | X | X | X | X | X | | | |
| D | LATIN CAPITAL LETTER D | 068 | 44 | 0100 0100 | X | X | X | X | X | | | |
| E | LATIN CAPITAL LETTER E | 069 | 45 | 0100 0101 | X | X | X | X | X | | | |
| F | LATIN CAPITAL LETTER F | 070 | 46 | 0100 0110 | X | X | X | X | X | | | |
| G | LATIN CAPITAL LETTER G | 071 | 47 | 0100 0111 | X | X | X | X | X | | | |
| H | LATIN CAPITAL LETTER H | 072 | 48 | 0100 1000 | X | X | X | X | X | | | |
| I | LATIN CAPITAL LETTER I | 073 | 49 | 0100 1001 | X | X | X | X | X | | | |
| J | LATIN CAPITAL LETTER J | 074 | 4A | 0100 1010 | X | X | X | X | X | | | |
| K | LATIN CAPITAL LETTER K | 075 | 4B | 0100 1011 | X | X | X | X | X | | | |
| L | LATIN CAPITAL LETTER L | 076 | 4C | 0100 1100 | X | X | X | X | X | | | |
| M | LATIN CAPITAL LETTER M | 077 | 4D | 0100 1101 | X | X | X | X | X | | | |
| N | LATIN CAPITAL LETTER N | 078 | 4E | 0100 1110 | X | X | X | X | X | | | |
| O | LATIN CAPITAL LETTER O | 079 | 4F | 0100 1111 | X | X | X | X | X | | | |
| P | LATIN CAPITAL LETTER P | 080 | 50 | 0101 0000 | X | X | X | X | X | | | |
| Q | LATIN CAPITAL LETTER Q | 081 | 51 | 0101 0001 | X | X | X | X | X | | | |
| R | LATIN CAPITAL LETTER R | 082 | 52 | 0101 0010 | X | X | X | X | X | | | |
| S | LATIN CAPITAL LETTER S | 083 | 53 | 0101 0011 | X | X | X | X | X | | | |
| T | LATIN CAPITAL LETTER T | 084 | 54 | 0101 0100 | X | X | X | X | X | | | |
| U | LATIN CAPITAL LETTER U | 085 | 55 | 0101 0101 | X | X | X | X | X | | | |
| V | LATIN CAPITAL LETTER V | 086 | 56 | 0101 0110 | X | X | X | X | X | | | |
| W | LATIN CAPITAL LETTER W | 087 | 57 | 0101 0111 | X | X | X | X | X | | | |
| X | LATIN CAPITAL LETTER X | 088 | 58 | 0101 1000 | X | X | X | X | X | | | |
| Y | LATIN CAPITAL LETTER Y | 089 | 59 | 0101 1001 | X | X | X | X | X | | | |
| Z | LATIN CAPITAL LETTER Z | 090 | 5A | 0101 1010 | X | X | X | X | X | | | |
| [ | LEFT SQUARE BRACKET | 091 | 5B | 0101 1011 | X | X | X | X | X | | | |
| \ | REVERSE SOLIDUS | 092 | 5C | 0101 1100 | X | X | X | X | X | | | |
| ] | RIGHT SQUARE BRACKET | 093 | 5D | 0101 1101 | X | X | X | X | X | | | |
| ^ | CIRCUMFLEX ACCENT | 094 | 5E | 0101 1110 | X | X | X | X | X | | | |
| _ | LOW LINE | 095 | 5F | 0101 1111 | X | X | X | X | X | | | |
| ` | GRAVE ACCENT | 096 | 60 | 0110 0000 | X | X | X | X | X | | | |
| a | LATIN SMALL LETTER A | 097 | 61 | 0110 0001 | X | X | X | X | X | | | |
| b | LATIN SMALL LETTER B | 098 | 62 | 0110 0010 | X | X | X | X | X | | | |
| c | LATIN SMALL LETTER C | 099 | 63 | 0110 0011 | X | X | X | X | X | | | |

| | Table A-3 NSIF 1-Byte Coded Characters | Code | | | Character Set | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|
| Char | Name | Dec | Hex | Binary | U8S | ECS | ECS-A | BCS | BCS-A | BCS-N | BCS-N Integer | BCS-N Positive Integers |
| d | LATIN SMALL LETTER D | 100 | 64 | 0110 0100 | X | X | X | X | X | | | |
| e | LATIN SMALL LETTER E | 101 | 65 | 0110 0101 | X | X | X | X | X | | | |
| f | LATIN SMALL LETTER F | 102 | 66 | 0110 0110 | X | X | X | X | X | | | |
| g | LATIN SMALL LETTER G | 103 | 67 | 0110 0111 | X | X | X | X | X | | | |
| h | LATIN SMALL LETTER H | 104 | 68 | 0110 1000 | X | X | X | X | X | | | |
| i | LATIN SMALL LETTER I | 105 | 69 | 0110 1001 | X | X | X | X | X | | | |
| j | LATIN SMALL LETTER J | 106 | 6A | 0110 1010 | X | X | X | X | X | | | |
| k | LATIN SMALL LETTER K | 107 | 6B | 0110 1011 | X | X | X | X | X | | | |
| l | LATIN SMALL LETTER L | 108 | 6C | 0110 1100 | X | X | X | X | X | | | |
| m | LATIN SMALL LETTER M | 109 | 6D | 0110 1101 | X | X | X | X | X | | | |
| n | LATIN SMALL LETTER N | 110 | 6E | 0110 1110 | X | X | X | X | X | | | |
| o | LATIN SMALL LETTER O | 111 | 6F | 0110 1111 | X | X | X | X | X | | | |
| p | LATIN SMALL LETTER P | 112 | 70 | 0111 0000 | X | X | X | X | X | | | |
| q | LATIN SMALL LETTER Q | 113 | 71 | 0111 0001 | X | X | X | X | X | | | |
| r | LATIN SMALL LETTER R | 114 | 72 | 0111 0010 | X | X | X | X | X | | | |
| s | LATIN SMALL LETTER S | 115 | 73 | 0111 0011 | X | X | X | X | X | | | |
| t | LATIN SMALL LETTER T | 116 | 74 | 0111 0100 | X | X | X | X | X | | | |
| u | LATIN SMALL LETTER U | 117 | 75 | 0111 0101 | X | X | X | X | X | | | |
| v | LATIN SMALL LETTER V | 118 | 76 | 0111 0110 | X | X | X | X | X | | | |
| w | LATIN SMALL LETTER W | 119 | 77 | 0111 0111 | X | X | X | X | X | | | |
| x | LATIN SMALL LETTER X | 120 | 78 | 0111 1000 | X | X | X | X | X | | | |
| y | LATIN SMALL LETTER Y | 121 | 79 | 0111 1001 | X | X | X | X | X | | | |
| z | LATIN SMALL LETTER Z | 122 | 7A | 0111 1010 | X | X | X | X | X | | | |
| { | LEFT CURLY BRACKET | 123 | 7B | 0111 1011 | X | X | X | X | X | | | |
| \| | VERTICAL LINE | 124 | 7C | 0111 1100 | X | X | X | X | X | | | |
| } | RIGHT CURLY BRACKET | 125 | 7D | 0111 1101 | X | X | X | X | X | | | |
| ~ | TILDE | 126 | 7E | 0111 1110 | X | X | X | X | X | | | |
| | NOT USED | 127 | 7F | 0111 1111 | | | | | | | | |
| | NOT USED | 128 | 80 | 1000 0000 | | | | | | | | |
| | NOT USED | 129 | 81 | 1000 0001 | | | | | | | | |
| | NOT USED | 130 | 82 | 1000 0010 | | | | | | | | |
| | NOT USED | 131 | 83 | 1000 0011 | | | | | | | | |
| | NOT USED | 132 | 84 | 1000 0100 | | | | | | | | |
| | NOT USED | 133 | 85 | 1000 0101 | | | | | | | | |

| | Table A-3 NSIF 1-Byte Coded Characters | Code | | | Character Set | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|
| Char | Name | Dec | Hex | Binary | U8S | ECS | ECS-A | BCS | BCS-A | BCS-N | BCS-N Integer | BCS-N Positive Integers |
| | NOT USED | 134 | 86 | 1000 0110 | | | | | | | | |
| | NOT USED | 135 | 87 | 1000 0111 | | | | | | | | |
| | NOT USED | 136 | 88 | 1000 1000 | | | | | | | | |
| | NOT USED | 137 | 89 | 1000 1001 | | | | | | | | |
| | NOT USED | 138 | 8A | 1000 1010 | | | | | | | | |
| | NOT USED | 139 | 8B | 1000 1011 | | | | | | | | |
| | NOT USED | 140 | 8C | 1000 1100 | | | | | | | | |
| | NOT USED | 141 | 8D | 1000 1101 | | | | | | | | |
| | NOT USED | 142 | 8E | 1000 1110 | | | | | | | | |
| | NOT USED | 143 | 8F | 1000 1111 | | | | | | | | |
| | NOT USED | 144 | 90 | 1001 0000 | | | | | | | | |
| | NOT USED | 145 | 91 | 1001 0001 | | | | | | | | |
| | NOT USED | 146 | 92 | 1001 0010 | | | | | | | | |
| | NOT USED | 147 | 93 | 1001 0011 | | | | | | | | |
| | NOT USED | 148 | 94 | 1001 0100 | | | | | | | | |
| | NOT USED | 149 | 95 | 1001 0101 | | | | | | | | |
| | NOT USED | 150 | 96 | 1001 0110 | | | | | | | | |
| | NOT USED | 151 | 97 | 1001 0111 | | | | | | | | |
| | NOT USED | 152 | 98 | 1001 1000 | | | | | | | | |
| | NOT USED | 153 | 99 | 1001 1001 | | | | | | | | |
| | NOT USED | 154 | 9A | 1001 1010 | | | | | | | | |
| | NOT USED | 155 | 9B | 1001 1011 | | | | | | | | |
| | NOT USED | 156 | 9C | 1001 1100 | | | | | | | | |
| | NOT USED | 157 | 9D | 1001 1101 | | | | | | | | |
| | NOT USED | 158 | 9E | 1001 1110 | | | | | | | | |
| | NOT USED | 159 | 9F | 1001 1111 | | | | | | | | |
| | NO BREAK SPACE | 160 | A0 | 1010 0000 | | X | X | | | | | |
| ¡ | INVERTED EXCLAMATION MARK | 161 | A1 | 1010 0001 | | X | X | | | | | |
| ¢ | CENT SIGN | 162 | A2 | 1010 0010 | | X | X | | | | | |
| £ | POUND SIGN | 163 | A3 | 1010 0011 | | X | X | | | | | |
| ¤ | CURRENCY SIGN | 164 | A4 | 1010 0100 | | X | X | | | | | |
| ¥ | YEN SIGN | 165 | A5 | 1010 0101 | | X | X | | | | | |
| ¦ | BROKEN BAR | 166 | A6 | 1010 0110 | | X | X | | | | | |
| § | SECTION SIGN | 167 | A7 | 1010 0111 | | X | X | | | | | |

| | Table A-3 NSIF 1-Byte Coded Characters | Code | | | Character Set | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|
| Char | Name | Dec | Hex | Binary | U8S | ECS | ECS-A | BCS | BCS-A | BCS-N | BCS-N Integer | BCS-N Positive Integers |
| ¨ | DIAERESIS | 168 | A8 | 1010 1000 | | X | X | | | | | |
| © | COPYRIGHT | 169 | A9 | 1010 1001 | | X | X | | | | | |
| ª | FEMININE ORDINAL INDICATOR | 170 | AA | 1010 1010 | | X | X | | | | | |
| « | LEFT-POINTING DOUBLE ANGLE QUOTATION MARK | 171 | AB | 1010 1011 | | X | X | | | | | |
| ¬ | NOT SIGN | 172 | AC | 1010 1100 | | X | X | | | | | |
| - | SOFT HYPHEN | 173 | AD | 1010 1101 | | X | X | | | | | |
| ® | REGISTERED SIGN | 174 | AE | 1010 1110 | | X | X | | | | | |
| ¯ | MACRON | 175 | AF | 1010 1111 | | X | X | | | | | |
| ° | DEGREE SIGN | 176 | B0 | 1011 0000 | | X | X | | | | | |
| ± | PLUS-MINUS SIGN | 177 | B1 | 1011 0001 | | X | X | | | | | |
| ² | SUPERSCRIPT TWO | 178 | B2 | 1011 0010 | | X | X | | | | | |
| ³ | SUPERSCRIPT THREE | 179 | B3 | 1011 0011 | | X | X | | | | | |
| ´ | ACUTE ACCENT | 180 | B4 | 1011 0100 | | X | X | | | | | |
| µ | MICRO SIGN | 181 | B5 | 1011 0101 | | X | X | | | | | |
| ¶ | PILCROW SIGN | 182 | B6 | 1011 0110 | | X | X | | | | | |
| · | MIDDLE DOT | 183 | B7 | 1011 0111 | | X | X | | | | | |
| ¸ | CEDILLA | 184 | B8 | 1011 1000 | | X | X | | | | | |
| ¹ | SUPERSCRIPT ONE | 185 | B9 | 1011 1001 | | X | X | | | | | |
| º | MASCULINE ORDINAL INDICATOR | 186 | BA | 1011 1010 | | X | X | | | | | |
| » | RIGHT-POINTING DOUBLE ANGLE QUOTATION MARK | 187 | BB | 1011 1011 | | X | X | | | | | |
| ¼ | VULGAR FRACTION ONE QUARTER | 188 | BC | 1011 1100 | | X | X | | | | | |
| ½ | VULGAR FRACTION ONE HALF | 189 | BD | 1011 1101 | | X | X | | | | | |
| ¾ | VULGAR FRACTION THREE QUARTERS | 190 | BE | 1011 1110 | | X | X | | | | | |
| ¿ | INVERTED QUESTION MARK | 191 | BF | 1011 1111 | | X | X | | | | | |
| À | CAP A W/GRAVE | 192 | C0 | 1100 0000 | | X | X | | | | | |
| Á | CAP A W/ACUTE | 193 | C1 | 1100 0001 | | X | X | | | | | |
| Â | CAP A W/CIRCUMFLEX | 194 | C2 | 1100 0010 | | X | X | | | | | |
| Ã | CAP A W/TILDE | 195 | C3 | 1100 0011 | | X | X | | | | | |
| Ä | CAP A W/DIAERESIS | 196 | C4 | 1100 0100 | | X | X | | | | | |
| Å | CAP A WITH RING ABOVE | 197 | C5 | 1100 0101 | | X | X | | | | | |
| Æ | CAP LIGATURE AE | 198 | C6 | 1100 0110 | | X | X | | | | | |
| Ç | CAP C W/CEDILLA | 199 | C7 | 1100 0111 | | X | X | | | | | |

| | Table A-3 NSIF 1-Byte Coded Characters | Code | | | Character Set | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|
| Char | Name | Dec | Hex | Binary | U8S | ECS | ECS-A | BCS | BCS-A | BCS-N | BCS-N Integer | BCS-N Positive Integers |
| È | CAP E W/GRAVE | 200 | C8 | 1100 1000 | | X | X | | | | | |
| É | CAP E W/ACUTE | 201 | C9 | 1100 1001 | | X | X | | | | | |
| Ê | CAP E W/CIRCUMFLEX | 202 | CA | 1100 1010 | | X | X | | | | | |
| Ë | CAP E W/DIAERESIS | 203 | CB | 1100 1011 | | X | X | | | | | |
| Ì | CAP I W/GRAVE | 204 | CC | 1100 1100 | | X | X | | | | | |
| Í | CAP I W/ACUTE | 205 | CD | 1100 1101 | | X | X | | | | | |
| Î | CAP I W/CIRCUMFLEX | 206 | CE | 1100 1110 | | X | X | | | | | |
| Ï | CAP I W/DIAERESIS | 207 | CF | 1100 1111 | | X | X | | | | | |
| Ð | CAP ETH (ICELANDIC) | 208 | D0 | 1101 0000 | | X | X | | | | | |
| Ñ | CAP N W/TILDE | 209 | D1 | 1101 0001 | | X | X | | | | | |
| Ò | CAP O W/GRAVE | 210 | D2 | 1101 0010 | | X | X | | | | | |
| Ó | CAP O W/ACUTE | 211 | D3 | 1101 0011 | | X | X | | | | | |
| Ô | CAP O W/CIRCUMFLEX | 212 | D4 | 1101 0100 | | X | X | | | | | |
| Õ | CAP O W/TILDE | 213 | D5 | 1101 0101 | | X | X | | | | | |
| Ö | CAP O W/DIAERESIS | 214 | D6 | 1101 0110 | | X | X | | | | | |
| × | MULTIPLICATION SIGN | 215 | D7 | 1101 0111 | | X | X | | | | | |
| Ø | CAP O W/STROKE | 216 | D8 | 1101 1000 | | X | X | | | | | |
| Ù | CAP U W/GRAVE | 217 | D9 | 1101 1001 | | X | X | | | | | |
| Ú | CAP U W/ACUTE | 218 | DA | 1101 1010 | | X | X | | | | | |
| Û | CAP U W/CIRCUMFLEX | 219 | DB | 1101 1011 | | X | X | | | | | |
| Ü | CAP U W/DIAERESIS | 220 | DC | 1101 1100 | | X | X | | | | | |
| Ý | CAP Y W/ACUTE | 221 | DD | 1101 1101 | | X | X | | | | | |
| Þ | CAP THORN (ICELANDIC) | 222 | DE | 1101 1110 | | X | X | | | | | |
| ß | CAP SHARP S (GERMAN) | 223 | DF | 1101 1111 | | X | X | | | | | |
| à | SMALL A W/GRAVE | 224 | E0 | 1110 0000 | | X | X | | | | | |
| á | SMALL A W/ACUTE | 225 | E1 | 1110 0001 | | X | X | | | | | |
| â | SMALL A W/CIRCUMFLEX | 226 | E2 | 1110 0010 | | X | X | | | | | |
| ã | SMALL A W/TILDE | 227 | E3 | 1110 0011 | | X | X | | | | | |
| ä | SMALL A W/DIAERESIS | 228 | E4 | 1110 0100 | | X | X | | | | | |
| å | SMALL A W/RING ABOVE | 229 | E5 | 1110 0101 | | X | X | | | | | |
| æ | SMALL LIGATURE AE | 230 | E6 | 1110 0110 | | X | X | | | | | |
| ç | SMALL C W/CEDILLA | 231 | E7 | 1110 0111 | | X | X | | | | | |
| è | SMALL E W/GRAVE | 232 | E8 | 1110 1000 | | X | X | | | | | |
| é | SMALL E W/ACUTE | 233 | E9 | 1110 1001 | | X | X | | | | | |

| | Table A-3 NSIF 1-Byte Coded Characters | Code | | | Character Set | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|
| Char | Name | Dec | Hex | Binary | U8S | ECS | ECS-A | BCS | BCS-A | BCS-N | BCS-N Integer | BCS-N Positive Integers |
| ê | SMALL E W/CIRCUMFLEX | 234 | EA | 1110 1010 | | X | X | | | | | |
| ë | SMALL E W/DIAERESIS | 235 | EB | 1110 1011 | | X | X | | | | | |
| ì | SMALL I W/GRAVE | 236 | EC | 1110 1100 | | X | X | | | | | |
| í | SMALL I W/ACUTE | 237 | ED | 1110 1101 | | X | X | | | | | |
| î | SMALL I W/CIRCUMFLEX | 238 | EE | 1110 1110 | | X | X | | | | | |
| ï | SMALL I W/DIAERESIS | 239 | EF | 1110 1111 | | X | X | | | | | |
| ð | SMALL ETH (ICLANDIC) | 240 | F0 | 1111 0000 | | X | X | | | | | |
| ñ | SMALL N W/TILDE | 241 | F1 | 1111 0001 | | X | X | | | | | |
| ò | SMALL O W/GRAVE | 242 | F2 | 1111 0010 | | X | X | | | | | |
| ó | SMALL O W/ACUTE | 243 | F3 | 1111 0011 | | X | X | | | | | |
| ô | SMALL O W/CIRCUMFLEX | 244 | F4 | 1111 0100 | | X | X | | | | | |
| õ | SMALL O W/TILDE | 245 | F5 | 1111 0101 | | X | X | | | | | |
| ö | SMALL O W/DIAERESIS | 246 | F6 | 1111 0110 | | X | X | | | | | |
| ÷ | DIVISION SIGN | 247 | F7 | 1111 0111 | | X | X | | | | | |
| ø | SMALL O W/STROKE | 248 | F8 | 1111 1000 | | X | X | | | | | |
| ù | SMALL U W/GRAVE | 249 | F9 | 1111 1001 | | X | X | | | | | |
| ú | SMALL U W/ACUTE | 250 | FA | 1111 1010 | | X | X | | | | | |
| û | SMALL U W/CIRCUMFLEX | 251 | FB | 1111 1011 | | X | X | | | | | |
| ü | SMALL U W/DIAERESIS | 252 | FC | 1111 1100 | | X | X | | | | | |
| ý | SMALL Y W/ACUTE | 253 | FD | 1111 1101 | | X | X | | | | | |
| þ | SMALL THORN (ICELANDIC) | 254 | FE | 1111 1110 | | X | X | | | | | |
| ÿ | SMALL Y W/DIAERESIS | 255 | FF | 1111 1111 | | X | X | | | | | |

# Table A-4. NSIF 2-Byte Coded Characters

Table A-4 NSIF 2-Byte Coded Characters

| CHAR | NAME | Hex | Binary | U8S |
|---|---|---|---|---|
| | NOT USED | C2 80 | 11000010 10000000 | |
| | NOT USED | C2 81 | 11000010 10000001 | |
| | NOT USED | C2 82 | 11000010 10000010 | |
| | NOT USED | C2 83 | 11000010 10000011 | |
| | NOT USED | C2 84 | 11000010 10000100 | |
| | NOT USED | C2 85 | 11000010 10000101 | |
| | NOT USED | C2 86 | 11000010 10000110 | |
| | NOT USED | C2 87 | 11000010 10000111 | |
| | NOT USED | C2 88 | 11000010 10001000 | |
| | NOT USED | C2 89 | 11000010 10001001 | |
| | NOT USED | C2 8A | 11000010 10001010 | |
| | NOT USED | C2 8B | 11000010 10001011 | |
| | NOT USED | C2 8C | 11000010 10001100 | |
| | NOT USED | C2 8D | 11000010 10001101 | |
| | NOT USED | C2 8E | 11000010 10001110 | |
| | NOT USED | C2 8F | 11000010 10001111 | |
| | NOT USED | C2 90 | 11000010 10010000 | |
| | NOT USED | C2 91 | 11000010 10010001 | |
| | NOT USED | C2 92 | 11000010 10010010 | |
| | NOT USED | C2 93 | 11000010 10010011 | |
| | NOT USED | C2 94 | 11000010 10010100 | |
| | NOT USED | C2 95 | 11000010 10010101 | |
| | NOT USED | C2 96 | 11000010 10010110 | |
| | NOT USED | C2 97 | 11000010 10010111 | |
| | NOT USED | C2 98 | 11000010 10011000 | |
| | NOT USED | C2 99 | 11000010 10011001 | |
| | NOT USED | C2 9A | 11000010 10011010 | |
| | NOT USED | C2 9B | 11000010 10011011 | |
| | NOT USED | C2 9C | 11000010 10011100 | |
| | NOT USED | C2 9D | 11000010 10011101 | |
| | NOT USED | C2 9E | 11000010 10011110 | |
| | NOT USED | C2 9F | 11000010 10011111 | |
| | NO BREAK SPACE | C2 A0 | 11000010 10100000 | X |
| ¡ | INVERTED EXCLAMATION MARK | C2 A1 | 11000010 10100001 | X |
| ¢ | CENT SIGN | C2 A2 | 11000010 10100010 | X |
| £ | POUND SIGN | C2 A3 | 11000010 10100011 | X |
| ¤ | CURRENCY SIGN | C2 A4 | 11000010 10100100 | X |
| ¥ | YEN SIGN | C2 A5 | 11000010 10100101 | X |
| ¦ | BROKEN BAR | C2 A6 | 11000010 10100110 | X |
| § | SECTION SIGN | C2 A7 | 11000010 10100111 | X |
| ¨ | DIAERESIS | C2 A8 | 11000010 10101000 | X |
| © | COPYRIGHT | C2 A9 | 11000010 10101001 | X |
| ª | FEMININE ORDINAL INDICATOR | C2 AA | 11000010 10101010 | X |
| « | LEFT-POINTING DOUBLE ANGLE QUOTATION MARK | C2 AB | 11000010 10101011 | X |
| ¬ | NOT SIGN | C2 AC | 11000010 10101100 | X |
| - | SOFT HYPHEN | C2 AD | 11000010 10101101 | X |
| ® | REGISTERED SIGN | C2 AE | 11000010 10101110 | X |
| ¯ | MACRON | C2 AF | 11000010 10101111 | X |

Table A-4 NSIF 2-Byte Coded Characters

| CHAR | NAME | Hex | Binary | U8S |
|---|---|---|---|---|
| ° | DEGREE SIGN | C2 B0 | 11000010 10110000 | X |
| ± | PLUS-MINUS SIGN | C2 B1 | 11000010 10110001 | X |
| ² | SUPERSCRIPT TWO | C2 B2 | 11000010 10110010 | X |
| ³ | SUPERSCRIPT THREE | C2 B3 | 11000010 10110011 | X |
| ´ | ACUTE ACCENT | C2 B4 | 11000010 10110100 | X |
| µ | MICRO SIGN | C2 B5 | 11000010 10110101 | X |
| ¶ | PILCROW SIGN | C2 B6 | 11000010 10110110 | X |
| · | MIDDLE DOT | C2 B7 | 11000010 10110111 | X |
| ¸ | CEDILLA | C2 B8 | 11000010 10111000 | X |
| ¹ | SUPERSCRIPT ONE | C2 B9 | 11000010 10111001 | X |
| º | MASCULINE ORDINAL INDICATOR | C2 BA | 11000010 10111010 | X |
| » | RIGHT POINTING DOUBLE ANGLE QUOTATION MARK | C2 BB | 11000010 10111011 | X |
| ¼ | VULGAR FRACTION ONE QUARTER | C2 BC | 11000010 10111100 | X |
| ½ | VULGAR FRACTION ONE HALF | C2 BD | 11000010 10111101 | X |
| ¾ | VULGAR FRACTION THREE QUARTERS | C2 BE | 11000010 10111110 | X |
| ¿ | INVERTED QUESTION MARK | C2 BF | 11000010 10111111 | X |
| À | CAP A W/GRAVE | C3 80 | 11000011 10000000 | X |
| Á | CAP A W/ACUTE | C3 81 | 11000011 10000001 | X |
| Â | CAP A W/CIRCUMFLEX | C3 82 | 11000011 10000010 | X |
| Ã | CAP A W/TILDE | C3 83 | 11000011 10000011 | X |
| Ä | CAP A W/DIAERESIS | C3 84 | 11000011 10000100 | X |
| Å | CAP A WITH RING ABOVE | C3 85 | 11000011 10000101 | X |
| Æ | CAP LIGATURE AE | C3 86 | 11000011 10000110 | X |
| Ç | CAP C W/CEDILLA | C3 87 | 11000011 10000111 | X |
| È | CAP E W/GRAVE | C3 88 | 11000011 10001000 | X |
| É | CAP E W/ACUTE | C3 89 | 11000011 10001001 | X |
| Ê | CAP E W/CIRCUMFLEX | C3 8A | 11000011 10001010 | X |
| Ë | CAP E W/DIAERESIS | C3 8B | 11000011 10001011 | X |
| Ì | CAP I W/GRAVE | C3 8C | 11000011 10001100 | X |
| Í | CAP I W/ACUTE | C3 8D | 11000011 10001101 | X |
| Î | CAP I W/CIRCUMFLEX | C3 8E | 11000011 10001110 | X |
| Ï | CAP I W/DIAERESIS | C3 8F | 11000011 10001111 | X |
| Ð | CAP ETH (ICELANDIC) | C3 90 | 11000011 10010000 | X |
| Ñ | CAP N W/TILDE | C3 91 | 11000011 10010001 | X |
| Ò | CAP O W/GRAVE | C3 92 | 11000011 10010010 | X |
| Ó | CAP O W/ACUTE | C3 93 | 11000011 10010011 | X |
| Ô | CAP O W/CIRCUMFLEX | C3 94 | 11000011 10010100 | X |
| Õ | CAP O W/TILDE | C3 95 | 11000011 10010101 | X |
| Ö | CAP O W/DIAERESIS | C3 96 | 11000011 10010110 | X |
| × | MULTIPLICATION SIGN | C3 97 | 11000011 10010111 | X |
| Ø | CAP O W/STROKE | C3 98 | 11000011 10011000 | X |
| Ù | CAP U W/GRAVE | C3 99 | 11000011 10011001 | X |
| Ú | CAP U W/ACUTE | C3 9A | 11000011 10011010 | X |
| Û | CAP U W/CIRCUMFLEX | C3 9B | 11000011 10011011 | X |
| Ü | CAP U W/DIAERESIS | C3 9C | 11000011 10011100 | X |
| Ý | CAP Y W/ACUTE | C3 9D | 11000011 10011101 | X |
| Þ | CAP THORN (ICELANDIC) | C3 9E | 11000011 10011110 | X |
| ß | CAP SHARP S (GERMAN) | C3 9F | 11000011 10011111 | X |
| à | SMALL A W/GRAVE | C3 A0 | 11000011 10100000 | X |
| á | SMALL A W/ACUTE | C3 A1 | 11000011 10100001 | X |
| â | SMALL A W/CIRCUMFLEX | C3 A2 | 11000011 10100010 | X |

Table A-4 NSIF 2-Byte Coded Characters

| CHAR | NAME | Hex | Binary | U8S |
|---|---|---|---|---|
| ã | SMALL A W/TILDE | C3 A3 | 11000011 10100011 | X |
| ä | SMALL A W/DIAERESIS | C3 A4 | 11000011 10100100 | X |
| å | SMALL A W/RING ABOVE | C3 A5 | 11000011 10100101 | X |
| æ | SMALL LIGATURE AE | C3 A6 | 11000011 10100110 | X |
| ç | SMALL C W/CEDILLA | C3 A7 | 11000011 10100111 | X |
| è | SMALL E W/GRAVE | C3 A8 | 11000011 10101000 | X |
| é | SMALL E W/ACUTE | C3 A9 | 11000011 10101001 | X |
| ê | SMALL E W/CIRCUMFLEX | C3 AA | 11000011 10101010 | X |
| ë | SMALL E W/DIAERESIS | C3 AB | 11000011 10101011 | X |
| ì | SMALL I W/GRAVE | C3 AC | 11000011 10101100 | X |
| í | SMALL I W/ACUTE | C3 AD | 11000011 10101101 | X |
| î | SMALL I W/CIRCUMFLEX | C3 AE | 11000011 0101110 | X |
| ï | SMALL I W/DIAERESIS | C3 AF | 11000011 0101111 | X |
| ð | SMALL ETH (ICLANDIC) | C3 B0 | 11000011 0110000 | X |
| ñ | SMALL N W/TILDE | C3 B1 | 11000011 0110001 | X |
| ò | SMALL O W/GRAVE | C3 B2 | 11000011 0110010 | X |
| ó | SMALL O W/ACUTE | C3 B3 | 11000011 0110011 | X |
| ô | SMALL O W/CIRCUMFLEX | C3 B4 | 11000011 0110100 | X |
| õ | SMALL O W/TILDE | C3 B5 | 11000011 0110101 | X |
| ö | SMALL O W/DIAERESIS | C3 B6 | 11000011 0110110 | X |
| ÷ | DIVISION SIGN | C3 B7 | 11000011 0110111 | X |
| ø | SMALL O W/STROKE | C3 B8 | 11000011 0111000 | X |
| ù | SMALL U W/GRAVE | C3 B9 | 11000011 0111001 | X |
| ú | SMALL U W/ACUTE | C3 BA | 11000011 0111010 | X |
| û | SMALL U W/CIRCUMFLEX | C3 BB | 11000011 0111011 | X |
| ü | SMALL U W/DIAERESIS | C3 BC | 11000011 0111100 | X |
| ý | SMALL Y W/ACUTE | C3 BD | 11000011 0111101 | X |
| þ | SMALL THORN (ICELANDIC) | C3 BE | 11000011 0111110 | X |
| ÿ | SMALL Y W/DIAERESIS | C3 BF | 11000011 0111111 | X |

# ANNEX B Sample Implementation

1. Use of NSIF.

Though the STANAG 4545 was conceived initially to support the transmission of a file composed of a single base image, image insets (subimage overlays), graphic overlays, and text, the format makes it suitable for a wide variety of data file exchange needs. One of the flexible features of the NSIF is that it allows several Segments to be included in one NSIF File, yet any of the data types may be omitted. Thus, for example, the NSIF may equally well be used for the storage of a single portion of text, a single image or a complex composition of several images, graphics, and text. The following section discusses an example NSIF File of moderate complexity. Information on other implementations can be found on the NSIF Registry on the Internet.

2. Example NSIF File.

Table B-1 shows the contents of the fields in the Header of a sample NSIF File composed of two ISs, (an image with an inset image), five GS overlays (two of which are multi-displayable element graphic segments), and five TS. Figure B-1 shows part of the sample NSIF File as a composite image with its overlay graphics. In a NSIF File, the data of each Segment is stored in a Data Field preceded by the Segment Subheader. The Subheader for a data type is omitted if no data of that type of Segment are included in the NSIF File. Segment Subheader Field contents in the sample NSIF File are shown in Table B-2 to Table B-9.


**Figure B-1. Sample NSIF File Composite Image**

# Table B-1.  Example NSIF File Header

Table B-1  E.g. NSIF File Header

| NITF HEADER FIELD | FORMAT | COMMENT |
|---|---|---|
| File Profile Name (FHDR) | NSIF | 4 characters |
| File Version (FVER) | 01.01 | 5 characters |
| Complexity Level (CLEVEL) | 05 | 2 characters -- images less than or equal to 8k x 8k but greater than 2k x 2k in either or both rows and columns |
| Standard Type (STYPE) | BF01 | 4 characters |
| Originating Station ID (OSTAID) | U21SOO90 | 8 characters followed by 2 BCS spaces (code 0x20) – 10 characters |
| File Date and Time (FDT) | 20001115224632 | 14 digits |
| File Title (FTITLE) | POL STORAGE FACILITY | 20 characters followed by 60 ECS spaces (code 0x20) - 80 characters |
| File Security Classification (FSCLAS) | U | 1 character |
| File Classification Security System (FSCLSY) | XN | 2 characters |
| File Codewords (FSCODE) | | 11 BCS spaces (code 0x20) |
| File Control and Handling (FSCTLH) | | 2 BCS spaces (code 0x20) |
| File Releasing Instructions (FSREL) | | 20 s BCS paces (code 0x20) |
| File Declassification Type (FSDCTP) | | 2 BCS spaces (code 0x20) |
| File Declassification Date (FSDCDT) | | 8 BCS spaces (code 0x20) |
| File Declassification Exemption (FSDCXM) | | 4 BCS spaces (code 0x20) |
| File Downgrade (FSDG) | | 1 BCS space (code 0x20) |
| File Downgrade Date (FSDGDT) | | 8 BCS spaces (code 0x20) |
| File Classification Text (FSCLTX) | | 43 ECS spaces (code 0x20) |
| File Classification Authority Type (FSCATP) | | 1 BCS space (code 0x20) |
| File Classification Authority (FSCAUT) | | 40 ECS spaces (code 0x20) |
| File Classification Reason (FSCRSN) | | 1 BCS space (code 0x20) |
| File Security Source Date (FSSRDT) | | 8 BCS spaces (code 0x20) |
| File Security Control Number (FSCTLN) | | 15 BCS spaces (code 0x20) |
| File Copy Number (FSCOP) | 00000 | 5 digits - all zeros indicate there is no tracking of NITF file copies |
| File Number of Copies (FSCPYS) | 00000 | 5 digits – all zeros indicate there is no tracking of NITF file copies |
| Encryption (ENCRYP) | 0 | 1 digit - required default |
| File Background Color (FBKGC) | 0x000000 | 3 bytes (binary) |

Table B-1 E.g. NSIF File Header

| NITF HEADER FIELD | FORMAT | COMMENT |
|---|---|---|
| Originator's Name (ONAME) | NSIF Custodian | 14 characters followed by 10 ECS spaces (code 0x20) - 24 characters |
| Originator's Phone Number (OPHONE) | 001 314 676-0290 | 16 characters followed by 2 BCS spaces (code 0x20) - 18 characters |
| File Length (FL) | 000002820308 | 12 digits |
| NITF File Header Length (HL) | 000515 | 6 digits |
| Number of Image Segments (NUMI) | 002 | 3 digits |
| Length of 1st Image Subheader (LISH001) | 000679 | 6 digits |
| Length of 1st Image Segment (LI001) | 0002730600 | 10 digits |
| Length of 2nd Image Subheader (LISH002) | 000439 | 6 digits |
| Length of 2nd Image Segment (LI002) | 0000082500 | 10 digits |
| Number of Graphics Segments (NUMS) | 005 | 3 digits |
| Length of 1st Graphic Subheader (LSSH001) | 0258 | 4 digits |
| Length of 1st Graphic Segment (LS001) | 000400 | 6 digits |
| Length of 2nd Graphic Subheader (LSSH002) | 0258 | 4 digits |
| Length of 2nd Graphic Segment (LS002) | 000406 | 6 digits |
| Length of 3rd Graphic Subheader (LSSH003) | 0258 | 4 digits |
| Length of 3rd Graphic Segment (LS003) | 000346 | 6 digits |
| Length of 4th Graphic Subheader (LSSH004) | 0258 | 4 digits |
| Length of 4th Graphic Segment (LS004) | 000354 | 6 digits |
| Length of 5th Graphic Subheader (LSSH005) | 0258 | 4 digits |
| Length of 5th Graphic Segment (LS005) | 000432 | 6 digits |
| Reserved for future use (NUMX) | 000 | 3 digits |
| Number of Text Files (NUMT) | 005 | 3 digits |
| Length of 1st Text Subheader (LTSH001) | 0282 | 4 digits |
| Length of 1st Text Segment (LT001) | 00137 | 5 digits |
| Length of 2nd Text Subheader (LTSH002) | 0282 | 4 digits |
| Length of 2nd Text Segment (LT002) | 00166 | 5 digits |
| Length of 3rd Text Subheader (LTSH003) | 0282 | 4 digits |
| Length of 3rd Text Segment (LT003) | 00089 | 5 digits |
| Length of 4th Text Subheader (LTSH004) | 0282 | 4 digits |
| Length of 4th Text Segment (LT004) | 00137 | 5 digits |
| Length of 5th Text Subheader (LTSH005) | 0282 | 4 digits |
| Length of 5th Text Segment (LT005) | 00408 | 5 digits |

Table B-1 E.g. NSIF File Header

| NITF HEADER FIELD | FORMAT | COMMENT |
|---|---|---|
| Number of Data Extension Segments (NUMDES) | 000 | 3 digits |
| Number of Reserved Extension Segments (NUMRES) | 000 | 3 digits |
| User-Defined Header Data Length (UDHDL) | 00000 | 5 digits |
| Extended Header Data Length (XHDL) | 00000 | 5 digits |

2.1 Explanation of the NSIF File Header (in order of appearance)

- The NSIF File Type and Version, NSIF 01.01.
- The NSIF File's CLEVEL, in this case 05.
- A four character reserved field for the Standard Type (STYPE), BF01.
- An identification code containing ten characters for the station originating the primary information in the NSIF File.
- The NSIF File origination date and time are given in UTC (Zulu) time format.
- The NSIF File Title (FTITLE) field containing up to 80 characters of free form text. The title of the sample NSIF File contains less than 80 characters, and therefore, the remainder of the field is padded with blanks.
- The File Security Classification (FSCLAS) follows and contains one character.
- Several security-related optional fields and a conditional field follow.
- Encryption (ENCRYP) is given a 0 indicating that the NSIF File is not encrypted.
- The File Background Color (FBKGC), defines the background color behind displayable segments. It eliminates the potential to visually lose information if the originator selects a presentation color that is the same as the receiver’s selected background color.
- The Originator's Name (ONAME) and the Originator’s Phone Number (OPHONE). These fields may be left blank.
- The length in bytes (File Length (FL) Field) of the entire NSIF File, including all Headers, Subheaders, and data.
- The length in bytes (HL field) of the NSIF File Header.
- The NUMI field contains the characters 002 to indicate two images are included in the NSIF File.
- Six characters to specify the LISH1, then ten characters for the LI1.
- The length of the second Image Subheader, LISH2, and The length of the second image, LI2.
- The Number of Graphics (NUMS) Field, which contains 005 to indicate that five graphics are present in the NSIF File.
- The Length of Graphic Subheader (LSSHn) and Length of Graphic (LSn) (four and six characters respectively) for the first to fifth graphics, one after the other.
- The field, Number of Text Files (NUMT), is given as 005.
- Four characters specifying the Length of the Text Subheader (LTSHn) and
- Five characters specifying the number of characters in the TS (Length of Text Segment (LTn) for each of the five TSs.
- The Number of Data Extension Segments (NUMDES), 000 and
- the Number of Reserved Extension Segments (NUMRES), 000.

(This completes the road map for separating the data Subheaders from the actual data to follow.)

- The next two fields in the Header are
- the User-Defined Header Data Length (UDHDL) and the UDHD. User-defined data could be used to include Registered or Controlled TREs that provide additional information about the NSIF File. In this example, however, the length of the UDHDL is given as zero; therefore, the UDHD field is omitted.
- The last field in the Header is the Extended Header Data Length (XHDL). The length of the Extended Header is given as zero; therefore, the XHDL field is omitted, indicating that no Registered or Controlled TREs are included in the NSIF File Header.

**Table B-2. Example of the First Image Subheader**

Table B-2 E.g. of the First Image Subheader († annotations are explained at the end of the table)

| NSIF IMAGE SUBHEADER FIELD | FORMAT | COMMENT |
|---|---|---|
| File Part Type (IM) | IM | 2 characters |
| Image Identifier 1 (IID1) | 0000000001 | 10 characters |
| Image Date and Time (IDATIM) | 19960825203147 | 14 digits |
| Target Identifier (TGTID) | | 17 BCS Spaces (code 0x20) |
| Image Identifier 2 (IID2) | MAJOR POL FACILITY AND HQ | 25 characters followed by 55 ECS Spaces - 80 characters |
| Image Security Classification (ISCLAS) | U | 1 character |
| Image Security Classification System (ISCLSY) | XN | 2 characters |
| Image Codewords (ISCODE) | | 11 BCS Spaces (code 0x20) |
| Image Control and Handling (ISCTLH) | | 2 BCS Spaces (code 0x20) |
| Image Releasing Instructions (ISREL) | | 20 BCS Spaces (code 0x20) |
| Image Declassification Type (ISDCTP) | | 2 BCS Spaces (code 0x20) |
| Image Declassification Date (ISDCDT) | | 8 BCS Spaces (code 0x20) |
| Image Declassification Exemption (ISDCXM) | | 4 BCS Spaces (code 0x20) |
| Image Downgrade (ISDG) | | 1 BCS Space (code 0x20) |
| Image Downgrade Date (ISDGDT) | | 8 BCS Spaces (code 0x20) |
| Image Classification Text (ISCLTX) | | 43 ECS Spaces (code 0x20) |
| Image Classification Authority Type (ISCATP) | | 1 BCS Space (code 0x20) |
| Image Classification Authority (ISCAUT) | | 40 ECS Spaces (code 0x20) |
| Image Classification Reason (ISCRSN) | | 1 BCS Space (code 0x20) |
| Image Security Source Date (ISSRDT) | | 8 BCS Spaces (code 0x20) |
| Image Security Control Number (ISCTLN) | | 15 BCS Spaces (code 0x20) |
| Encryption (ENCRYP) | 0 | 1 digit - required default |
| Image Source (ISORCE) | Hand-held digital camera model XYZ. | 35 characters followed by 7 ECS Spaces (code 0x20) - 42 characters |
| Number of Significant Rows in Image (NROWS) | 00001332 | 8 digits |
| Number of Significant Columns in Image (NCOLS) | 00002050 | 8 digits |
| Pixel Value Type (PVTYPE) | INT | 3 characters - indicating pixel values as integers |
| Image Representation (IREP) | MONO | 4 characters followed by 4 BCS Spaces (code 0x20) - grey scale imagery |
| Image Category (ICAT) | VIS | 3 characters followed by 5 BCS Spaces (code 0x20) - visible imagery |

Table B-2 E.g. of the First Image Subheader († annotations are explained at the end of the table)

| NSIF IMAGE SUBHEADER FIELD | FORMAT | COMMENT |
|---|---|---|
| Actual Bits-Per-Pixel per Band (ABPP) | 08 | 2 digits |
| Pixel Justification (PJUST) | R | 1 character |
| Image Coordinate Representation (ICORDS) | | BCS Space (code 0x20) - indicates no geo location coordinates |
| Number of Image Comments (NICOM) | 3 | 1 digit |
| †[2] Image Comment 1 (ICOM1) | This is a comment on the Major POL facility and associated overlays. This file | 80 characters |
| †[2] Image Comment 2 (ICOM2) | was developed for the Custodian as an example for potential developers in assist | 80 characters |
| †[2] Image Comment 3 (ICOM3) | ing them in the understanding of NSIF. | 39 characters followed by 41 ECS Spaces (code 0x20) - 80 characters |
| Image Compression (IC) | NC | 2 characters - indicates no compression |
| Number of Bands (NBANDS) | 1 | 1 digit |
| 1st Band Representation (IREPBAND1) | | 2 BCS Spaces (code 0x20) |
| 1st Band Subcategory (ISUBCAT1) | | 6 BCS Spaces (code 0x20) |
| 1st Band Image Filter Condition (IFC1) | N | 1 character - required default value |
| 1st Band Standard Image Filter Code (IMFLT1) | | 3 BCS Spaces (code 0x20) - reserved |
| Number of LUTs for the 1st Image Band (NLUTS1) | 0 | 1 digit |
| Image Sync Code (ISYNC) | 0 | 1 digit |
| Image Mode (IMODE) | B | 1 character - B required for 1 band |
| Number of Blocks Per Row (NBPR) | 0001 | 4 digits |
| Number of Blocks Per Column (NBPC) | 0001 | 4 digits |
| Number of Pixels Per Block Horizontal (NPPBH) | 2050 | 4 digits |
| Number of Pixels Per Block Vertical (NPPBV) | 1332 | 4 digits |
| Number of Bits Per Pixel (NBPP) | 08 | 2 digits |
| Image Display Level (IDLVL) | 001 | 3 digits - minimum DLVL requires this value |
| Image Attachment Level (IALVL) | 000 | required 3 digit value since minimum DLVL. |
| Image Location (ILOC) | 0000000000 | 10 digits upper left pixel located at origin of CCS |
| Image Magnification (IMAG) | 1.0 | 3 character followed by a BCS Spaces (code 0x20) - 4 characters |
| User-Defined Image Data Length (UDIDL) | 00000 | 5 digits |
| Image Extended Subheader Data Length (IXSHDL) | 00000 | 5 digits |

†[2] According to the standard - this should look like a single contiguous comment of up to three 80 character blocks.

2.2 Explanation of the First Image Subheader.

There are two images in this sample NSIF File. The first image has IDLVL001. Its Subheader is shown in Table B-2. It is an unclassified, single band, single block, grey scale image with 8 bits per pixel and does not have an associated LUT. There are three associated comments. It is visible imagery, does not have geo-location data and is stored as an uncompressed image. It is located at the origin of the CCS within which all the displayable NSIF File components are located. It is 1332 rows by 2050 columns. Figure B-1 illustrates the image printed at approximately three hundred pixels per inch.

**Table B-3. Example of the Second Image Subheader**

Table B-3 E.g. of the Second Image Subheader

| NSIF IMAGE SUBHEADER FIELD | FORMAT | COMMENT |
|---|---|---|
| File Part Type (IM) | IM | 2 characters |
| Image Identifier 1 (IID1) | Missing ID | 10 characters |
| Image Date and Time (IDATIM) | 19960927011729 | 14 digits |
| Target Identifier (TGTID) | | 17 BCS Spaces (code 0x20) |
| Image Identifier 2 (IID2) | Zoomed Facility | 15 characters followed by 65 ECS Spaces (code 0x20) - 80 characters |
| Image Security Classification (ISCLAS) | U | 1 character |
| Image Security Classification System (ISCLSY) | XN | 2 characters |
| Image Codewords (ISCODE) | | 11 BCS Spaces (code 0x20) |
| Image Control and Handling (ISCTLH) | | 2 BCS Spaces (code 0x20) |
| Image Releasing Instructions (ISREL) | | 20 BCS Spaces (code 0x20) |
| Image Declassification Type (ISDCTP) | | 2 BCS Spaces (code 0x20) |
| Image Declassification Date (ISDCDT) | | 8 BCS Spaces (code 0x20) |
| Image Declassification Exemption (ISDCXM) | | 4 BCS Spaces (code 0x20) |
| Image Downgrade (ISDG) | | 1 BCS Space (code 0x20) |
| Image Downgrade Date (ISDGDT) | | 8 BCS Spaces (code 0x20) |
| Image Classification Text (ISCLTX) | | 43 ECS Spaces (code 0x20) |
| Image Classification Authority Type (ISCATP) | | 1 BCS Space (code 0x20) |
| Image Classification Authority (ISCAUT) | | 40 ECS Spaces (code 0x20) |
| Image Classification Reason (ISCRSN) | | 1 BCS Space (code 0x20) |
| Image Security Source Date (ISSRDT) | | 8 BCS Spaces (code 0x20) |
| Image Security Control Number (ISCTLN) | | 15 BCS Spaces (code 0x20) |
| Encryption (ENCRYP) | 0 | 1 digit - required default |
| Image Source (ISORCE) | Cut of original image. | 22 characters followed by 20 ECS Spaces (code 0x20) - 42 characters |
| Number of Significant Rows in Image (NROWS) | 00000275 | 8 digits |
| Number of Significant Columns in Image (NCOLS) | 00000300 | 8 digits |
| Pixel Value Type (PVTYPE) | INT | 3 characters - indicating pixel values as integers |
| Image Representation (IREP) | MONO | 4 characters followed by 4 BCS Spaces (code 0x20) - grey scale imagery |
| Image Category (ICAT) | VIS | 3 characters followed by 5 BCS Spaces (code 0x20) - visible imagery |
| Actual Bits-Per-Pixel per Band (ABPP) | 08 | 2 digits |
| Pixel Justification (PJUST) | R | 1 character |
| Image Coordinate Representation (ICORDS) | | BCS Space (0x20) indicates no geo location coordinates |
| Number of Image Comments (NICOM) | 0 | 1 digit |

Table B-3  E.g. of the Second Image Subheader

| NSIF IMAGE SUBHEADER FIELD | FORMAT | COMMENT |
|---|---|---|
| Image Compression (IC) | NC | 2 characters - indicates uncompressed |
| Number of Bands (NBANDS) | 1 | 1 digit |
| 1st Band Representation (IREPBAND1) | M | 1 Character and 1 BCS Space (code 0x20) |
| 1st Band Subcategory (ISUBCAT1) | | 6 BCS Spaces (code 0x20) |
| 1st Band Image Filter Condition (IFC1) | N | 1 character - required default value |
| 1st Band Standard Image Filter Code (IMFLT1) | | 3 BCS Spaces (code 0x20) - reserved |
| Number of LUTs for the 1st Image Band (NLUTS1) | 0 | 1 digit |
| Image Sync Code (ISYNC) | 0 | 1 digit |
| Image Mode (IMODE) | B | 1 character - B required for 1 band |
| Number of Blocks Per Row (NBPR) | 0001 | 4 digits |
| Number of Blocks Per Column (NBPC) | 0001 | 4 digits |
| Number of pixels Per Block Horizontal (NPPBH) | 0300 | 4 digits |
| Number of Pixels Per Block Vertical (NPPBV) | 0275 | 4 digits |
| Number Bits Per Pixel per Band(NBPP) | 08 | 2 digits |
| Image Display Level (IDLVL) | 002 | 3 digits |
| Image Attachment Level (IALVL) | 001 | 3 digits |
| Image Location (ILOC) | 0090000320 | 10 digits, located at row 880 column 205 of base image |
| Image Magnification (IMAG) | 1.0 | 3 characters followed by a BCS Spaces (code 0x20) - 4 characters |
| User-Defined Image Data Length (UDIDL) | 00000 | 5 digits |
| Image Extended Subheader Data Length (IXSHDL) | 00000 | 5 digits |

2.3 Explanation of the Second Image Subheader.

This image is the second image in the NSIF File. As is the first image, this image is an 8 bit visible, grey scale image. It is much smaller (300 columns x 275 rows) and is not compressed. Also, unlike the first image, it has no associated comment fields, indicated by the fact that the value of the Number of Image Comments (NICOM) Field is equal to zero. Since it is attached to the base image (IALVL contains 001), the ILOC field reveals that this image is located with its upper left corner positioned at Row 900, Column 320 with respect to the upper left corner of the base image. Since it has a DLVL greater than that of the base image, it will obscure part of the base image when they are both displayed.

## Table B-4.  Example of the First Graphic Subheader

Table B-4  E.g. of the First Graphic Subheader

| NSIF GRAPHIC SUBHEADER FIELD | FORMAT | COMMENT |
|---|---|---|
| File Part Type (SY) | SY | 2 |
| Graphic Identifier (SID) | 0000000001 | 10 |
| Graphic Name (SNAME) | Special Aircraft Pad | 20 characters |
| Graphic Security Classification (SSCLAS) | U | 1 character |
| Graphic Security Classification System (SSCLSY) | XN | 2 characters |

Table B-4 E.g. of the First Graphic Subheader

| NSIF GRAPHIC SUBHEADER FIELD | FORMAT | COMMENT |
|---|---|---|
| Graphic Codewords (SSCODE) | | 11 BCS Spaces (code 0x20) |
| Graphic Control and Handling (SSCTLH) | | 2 BCS Spaces (code 0x20) |
| Graphic Releasing Instructions (SSREL) | | 20 BCS Spaces (code 0x20) |
| Graphic Declassification Type (SSDCTP) | | 2 BCS Spaces (code 0x20) |
| Graphic Declassification Date (SSDCDT) | | 8 BCS Spaces (code 0x20) |
| Graphic Declassification Exemption (SSDCXM) | | 4 BCS Spaces (code 0x20) |
| Graphic Downgrade (SSDG) | | 1 BCS Space (code 0x20) |
| Graphic Downgrade Date (SSDGDT) | | 8 BCS Spaces (code 0x20) |
| Graphic Classification Text (SSCLTX) | | 43 ECS Spaces (code 0x20) |
| Graphic Classification Authority Type (SSCATP) | | 1 BCS Space (code 0x20) |
| Graphic Classification Authority (SSCAUT) | | 40 ECS Spaces (code 0x20) |
| Graphic Classification Reason (SSCRSN) | | 1 BCS Space (code 0x20) |
| Graphic Security Source Date (SSSRDT) | | 8 BCS Spaces (code 0x20) |
| Graphic Security Control Number (SSCTLN) | | 15 BCS Spaces (code 0x20) |
| Encryption (ENCRYP) | 0 | 1 digit - required default |
| Graphic Type (SFMT) | C | 1 character - indicates CGM |
| Reserved for Future Use (SSTRUCT) | 0000000000000 | 13 BCS Zeros (code 0x30) - reserved |
| Graphic Display Level (SDLVL) | 003 | 3 digits |
| Graphic Attachment Level (SALVL) | 001 | 3 digits |
| Graphic Location (SLOC) | 0081501005 | 10 digits |
| First Graphic Bound Location (SBND1) | 0081501005 | 10 digits |
| Graphic Color (SCOLOR) | M | indicates CGM File contains no color components |
| Second Graphic Bound Location (SBND2) | 0099501180 | 10 digits |
| Reserved for Future Use (SRES2) | 00 | 2 BCS Zeros (code 0x30) - reserved |
| Graphic Extended Subheader Data Length (SXSHDL) | 00000 | 5 digits |

2.4 Explanation of the First Graphic Subheader.

This graphic is a computer graphics metafile graphic (Special Aircraft Pad). The graphic is attached to the base image, and its location is recorded in SLOC (row 815, column 1005) and is measured as an offset from the origin at the upper left corner of that image.

## Table B-5. Example of the Second Graphic Subheader

Table B-5 E.g. of the Second Graphic Subheader

| NSIF GRAPHIC SUBHEADER FIELD | FORMAT | COMMENT |
|---|---|---|
| File Part Type (SY) | SY | 2 |
| Graphic Identifier (SID) | 0000000002 | 10 |
| Graphic Name (SNAME) | ARROW | 5 characters followed by 15 ECS Spaces (code 0x20) - 20 characters |
| Graphic Security Classification (SSCLAS) | U | 1 character |
| Graphic Security Classification System (SSCLSY) | XN | 2 characters |

Table B-5 E.g. of the Second Graphic Subheader

| NSIF GRAPHIC SUBHEADER FIELD | FORMAT | COMMENT |
|---|---|---|
| Graphic Codewords (SSCODE) | | 11 BCS Spaces (code 0x20) |
| Graphic Control and Handling (SSCTLH) | | 2 BCS Spaces (code 0x20) |
| Graphic Releasing Instructions (SSREL) | | 20 BCS Spaces (code 0x20) |
| Graphic Declassification Type (SSDCTP) | | 2 BCS Spaces (code 0x20) |
| Graphic Declassification Date (SSDCDT) | | 8 BCS Spaces (code 0x20) |
| Graphic Declassification Exemption (SSDCXM) | | 4 BCS Spaces (code 0x20) |
| Graphic Downgrade (SSDG) | | 1 BCS Space (code 0x20) |
| Graphic Downgrade Date (SSDGDT) | | 8 BCS Spaces (code 0x20) |
| Graphic Classification Text (SSCLTX) | | 43 ECS Spaces (code 0x20) |
| Graphic Classification Authority Type (SSCATP) | | 1 BCS Space (code 0x20) |
| Graphic Classification Authority (SSCAUT) | | 40 ECS Spaces (code 0x20) |
| Graphic Classification Reason (SSCRSN) | | 1 BCS Space (code 0x20) |
| Graphic Security Source Date (SSSRDT) | | 8 BCS Spaces (code 0x20) |
| Graphic Security Control Number (SSCTLN) | | 15 BCS Spaces (code 0x20) |
| Encryption (ENCRYP) | 0 | 1 digit - required default |
| Graphic Type (SFMT) | C | 1 character - indicates CGM |
| Reserved for Future Use (SSTRUCT) | 0000000000000 | 13 BCS Zeros (code 0x30) - reserved |
| Graphic Display Level (SDLVL) | 004 | 3 digits |
| Graphic Attachment Level (SALVL) | 002 | 3 digits |
| Graphic Location (SLOC) | -010500115 | 10 digits relative to origin of second image |
| First Graphic Bound Location (SBND1) | 0079500435 | 10 digits relative to origin of second image |
| Graphic Color (SCOLOR) | M | indicates CGM File contains no color components |
| Second Graphic Bound Location (SBND2) | 0089500475 | 10 digits relative to origin of second image |
| Reserved for Future Use (SRES2) | 00 | 2 BCS Zeros (code 0x30) - reserved |
| Graphic Extended Subheader Data Length (SXSHDL) | 00000 | 5 digits |

2.5 Explanation of the Second Graphic Subheader.

The second graphic is also a CGM graphic. It is the arrow pointing to the POL Tank Facility. It is attached to the subimage. Therefore, its location as recorded in the SLOC field is measured as an offset from the upper left corner of the subimage.

# Table B-6. Example of the Third Graphic Subheader

Table B-6 E.g. of the Third Graphic Subheader

| NSIF GRAPHIC SUBHEADER FIELD | FORMAT | COMMENT |
|---|---|---|
| File Part Type (SY) | SY | 2 |
| Graphic Identifier (SID) | 0000000003 | 10 |
| Graphic Name (SNAME) | HQ BUILDING | 11 characters followed by 9 ECS Spaces (code 0x20) - 20 characters |
| Graphic Security Classification (SSCLAS) | U | 1 character |
| Graphic Security Classification System (SSCLSY) | XN | 2 characters |
| Graphic Codewords (SSCODE) | | 11 BCS Spaces (code 0x20) |
| Graphic Control and Handling (SSCTLH) | | 2 BCS Spaces (code 0x20) |
| Graphic Releasing Instructions (SSREL) | | 20 BCS Spaces (code 0x20) |
| Graphic Declassification Type (SSDCTP) | | 2 BCS Spaces (code 0x20) |
| Graphic Declassification Date (SSDCDT) | | 8 BCS Spaces (code 0x20) |
| Graphic Declassification Exemption (SSDCXM) | | 4 BCS Spaces (code 0x20) |
| Graphic Downgrade (SSDG) | | 1 BCS Space (code 0x20) |
| Graphic Downgrade Date (SSDGDT) | | 8 BCS Spaces (code 0x20) |
| Graphic Classification Text (SSCLTX) | | 43 ECS Spaces (code 0x20) |
| Graphic Classification Authority Type (SSCATP) | | 1 BCS Space (code 0x20) |
| Graphic Classification Authority (SSCAUT) | | 40 ECS Spaces (code 0x20) |
| Graphic Classification Reason (SSCRSN) | | 1 BCS Space (code 0x20) |
| Graphic Security Source Date (SSSRDT) | | 8 BCS Spaces (code 0x20) |
| Graphic Security Control Number (SSCTLN) | | 15 BCS Spaces (code 0x20) |
| Encryption (ENCRYP) | 0 | 1 digit - required default |
| Graphic Type (SFMT) | C | 1 character - indicates CGM |
| Reserved for Future Use (SSTRUCT) | 0000000000000 | 13 BCS Zeros (code 0x30) - reserved |
| Graphic Display Level (SDLVL) | 005 | 3 digits |
| Graphic Attachment Level (SALVL) | 001 | 3 digits |
| Graphic Location (SLOC) | 0000000000 | 10 digits |
| First Graphic Bound Location (SBND1) | 0105501000 | 10 digits |
| Graphic Color (SCOLOR) | M | indicates CGM File contains no color components |
| Second Graphic Bound Location (SBND2) | 0107501160 | 10 digits |
| Reserved for Future Use (SRES2) | 00 | 2 BCS Zeros (code 0x30) - reserved |
| Graphic Extended Subheader Data Length (SXSHDL) | 00000 | 5 digits |

2.6 Explanation of the Third Graphic Subheader.

The third graphic is a CGM annotation (HQ Building). It is attached to the base image. Its location as recorded in the SLOC field is measured as an offset from the upper left corner of the base image, in this case the value of the SLOC field is (0,0) and the offsetting for this graphic is actually done within the CGM construct itself.

## Table B-7. Example of the Fourth Graphic Subheader

Table B-7 E.g. of the Fourth Graphic Subheader

| NSIF GRAPHIC SUBHEADER FIELD | FORMAT | COMMENT |
|---|---|---|
| File Part Type (SY) | SY | 2 |
| Graphic Identifier (SID) | 0000000004 | 10 |
| Graphic Name (SNAME) | POL TANK FACILITY | 17 characters followed by 3 ECS Space (code 0x20) - 20 characters |
| Graphic Security Classification (SSCLAS) | U | 1 character |
| Graphic Security Classification System (SSCLSY) | XN | 2 characters |
| Graphic Codewords (SSCODE) | | 11 BCS Spaces (code 0x20) |
| Graphic Control and Handling (SSCTLH) | | 2 BCS Spaces (code 0x20) |
| Graphic Releasing Instructions (SSREL) | | 20 BCS Spaces (code 0x20) |
| Graphic Declassification Type (SSDCTP) | | 2 BCS Spaces (code 0x20) |
| Graphic Declassification Date (SSDCDT) | | 8 BCS Spaces (code 0x20) |
| Graphic Declassification Exemption (SSDCXM) | | 4 BCS Spaces (code 0x20) |
| Graphic Downgrade (SSDG) | | 1 BCS Space (code 0x20) |
| Graphic Downgrade Date (SSDGDT) | | 8 BCS Spaces (code 0x20) |
| Graphic Classification Text (SSCLTX) | | 43 ECS Spaces (code 0x20) |
| Graphic Classification Authority Type (SSCATP) | | 1 BCS Space (code 0x20) |
| Graphic Classification Authority (SSCAUT) | | 40 ECS Spaces (code 0x20) |
| Graphic Classification Reason (SSCRSN) | | 1 BCS Space (code 0x20) |
| Graphic Security Source Date (SSSRDT) | | 8 BCS Spaces (code 0x20) |
| Graphic Security Control Number (SSCTLN) | | 15 BCS Spaces (code 0x20) |
| Encryption (ENCRYP) | 0 | 1 digit - required default |
| Graphic Type (SFMT) | C | 1 character - indicates CGM |
| Reserved for Future Use (SSTRUCT) | 0000000000000 | 13 BCS Zeros (code 0x30) |
| Graphic Display Level (SDLVL) | 006 | 3 digits |
| Graphic Attachment Level (SALVL) | 002 | 3 digits |
| Graphic Location (SLOC) | 0020000020 | 10 digits relative to origin of second image |
| First Graphic Bound Location (SBND1) | 0110000350 | 10 digits relative to origin of second image |
| Graphic Color (SCOLOR) | M | Indicates CGM File contains no color components |
| Second Graphic Bound Location (SBND2) | 0113000600 | 10 digits relative to origin of second image |
| Reserved for Future Use (SRES2) | 00 | 2 BCS Zeros (code 0x30) - reserved |
| Graphic Extended Subheader Data Length (SXSHDL) | 00000 | 5 digits |

2.7 Explanation of the Fourth Graphic Subheader.

The fourth graphic is a CGM graphic. It is the MAJOR TEST FACILITY text. It is attached to the subimage. Therefore, its location as recorded in the SLOC field is measured as an offset from the upper left corner of the subimage.

## Table B-8. Example of the Fifth Graphic Subheader

Table B-8 E.g. of the FifthGraphic Subheader

| NSIF GRAPHIC SUBHEADER FIELD | FORMAT | COMMENT |
|---|---|---|
| File Part Type (SY) | SY | 2 |
| Graphic Identifier (SID) | 0000000005 | 10 |
| Graphic Name (SNAME) | COMMUNICATION ARROW | 19 characters followed by 1 ECS Space (code 0x20) - 20 characters |
| Graphic Security Classification (SSCLAS) | U | 1 character |
| Graphic Security Classification System (SSCLSY) | XN | 2 characters |
| Graphic Codewords (SSCODE) | | 11 BCS Spaces (code 0x20) |
| Graphic Control and Handling (SSCTLH) | | 2 BCS Spaces (code 0x20) |
| Graphic Releasing Instructions (SSREL) | | 20 BCS Spaces (code 0x20) |
| Graphic Declassification Type (SSDCTP) | | 2 BCS Spaces (code 0x20) |
| Graphic Declassification Date (SSDCDT) | | 8 BCS Spaces (code 0x20) |
| Graphic Declassification Exemption (SSDCXM) | | 4 BCS Spaces (code 0x20) |
| Graphic Downgrade (SSDG) | | 1 BCS Space (code 0x20) |
| Graphic Downgrade Date (SSDGDT) | | 8 BCS Spaces (code 0x20) |
| Graphic Classification Text (SSCLTX) | | 43 ECS Spaces (code 0x20) |
| Graphic Classification Authority Type (SSCATP) | | 1 BCS Space (code 0x20) |
| Graphic Classification Authority (SSCAUT) | | 40 ECS Spaces (code 0x20) |
| Graphic Classification Reason (SSCRSN) | | 1 BCS Space (code 0x20) |
| Graphic Security Source Date (SSSRDT) | | 8 BCS Spaces (code 0x20) |
| Graphic Security Control Number (SSCTLN) | | 15 BCS Spaces (code 0x20) |
| Encryption (ENCRYP) | 0 | 1 digit - required default |
| Graphic Type (SFMT) | C | 1 character - indicates CGM |
| Reserved for Future Use (SSTRUCT) | 0000000000000 | 13 BCS Zeros (code 0x30) |
| Graphic Display Level (SDLVL) | 007 | 3 digits |
| Graphic Attachment Level (SALVL) | 001 | 3 digits |
| Graphic Location (SLOC) | 0019600535 | 10 digits |
| First Graphic Bound Location (SBND1) | 0020500545 | 10 digits |
| Graphic Color (SCOLOR) | M | Indicates CGM File contains no color components |
| Second Graphic Bound Location (SBND2) | 0028000845 | 10 digits |
| Reserved for Future Use (SRES2) | 00 | 2 BCS Zeros (code 0x30) - reserved |
| Graphic Extended Subheader Data Length (SXSHDL) | 00000 | 5 digits |

2.8 Explanation of the Fifth Graphic Subheader.

The fifth graphic is a CGM graphic. It is the COMMUNICATIONS NODE annotation with associated arrow. It is attached to the base image. Therefore, its location as recorded in the SLOC field is measured as an offset from the upper left corner of the base image.

## Table B-9. Example of the First Text Subheader

Table B-9 E.g. of the First Text Subheader

| NSIF TEXT SUBHEADER FIELD | FORMAT | COMMENT |
|---|---|---|
| File Part Type (TE) | TE | 2 characters |
| Text Identifier (TEXTID) | 0000001 | 7 characters |
| Text Attachment Level (TXTALVL) | 001 | 3 characters |
| Text Date and Time (TXTDT) | 19960930224530 | 14 characters |
| Text Title (TXTITL) | First Sample text File. | 23 characters followed by 57 ECS Spaces (code 0x20) - 80 characters |
| Text Security Classification (TSCLAS) | U | 1 character |
| Text Security Classification System (TSCLSY) | XN | 2 characters |
| Text Codewords (TSCODE) | | 11 BCS Spaces (code 0x20) |
| Text Control and Handling (TSCTLH) | | 2 BCS Spaces (code 0x20) |
| Text Releasing Instructions (TSREL) | | 20 BCS Spaces (code 0x20) |
| Text Declassification Type (TSDCTP) | | 2 BCS Spaces (code 0x20) |
| Text Declassification Date (TSDCDT) | | 8 BCS Spaces (code 0x20) |
| Text Declassification Exemption (TSDCXM) | | 4 BCS Spaces (code 0x20) |
| Text Downgrade (TSDG) | | 1 BCS Space (code 0x20) |
| Text Downgrade Date (TSDGDT) | | 8 BCS Spaces (code 0x20) |
| Text Classification Text (TSCLTX) | | 43 ECS Spaces (code 0x20) |
| Text Classification Authority Type (TSCATP) | | 1 BCS Space (code 0x20) |
| Text Classification Authority (TSCAUT) | | 40 ECS Spaces (code 0x20) |
| Text Classification Reason (TSCRSN) | | 1 BCS Space (code 0x20) |
| Text Security Source Date (TSSRDT) | | 8 BCS Spaces (code 0x20) |
| Text Security Control Number (TSCTLN) | | 15 BCS Spaces (code 0x20) |
| Encryption (ENCRYP) | 0 | 1 digit - required default |
| Text Format (TXTFMT) | STA | 3 characters |
| Text Extended Subheader Data Length (TXSHDL) | 00000 | 5 digits |

2.9 Explanation of the Text Subheaders.

There are 5 text subheaders included in the NSIF File. Other than the text data they differ only in matters such as title, date-time of creation, and ID. Therefore, only the first is discussed, since the Subheaders of all the rest are essentially the same. The first TS is unclassified and was created on September 30, 1996 at 22:45 hours. Its Subheader is shown in Table B-9.

# ANNEX C NSIF Test Criteria (NTC)

EXECUTIVE SUMMARY

This Annex describes the North Atlantic Treaty Organization (NATO) Standardization Agreement 4545 Secondary Imagery Format (STANAG 4545:NSIF) version 1.1 testing criteria. NATO is committed to achieve and sustain NSIF compliance with all fielded digital secondary imagery systems.

NATO Joint Capability Group on ISR (JCGISR), the Tasking Authority for the Custodian of NATO Standardization Agreement (STANAG) 4545, oversees the process whereby digital secondary imagery systems achieve and sustain STANAG 4545 compliance through the NSIF Test Program.
The NSIF Test Program policies and procedures are outlined in the NATO ISR Interoperability Architecture (NIIA) Test and Evaluation Program Plan, AEDP-2, Volume 2, Annex B. Implementation sponsors request and sustain NSIF compliance by adherence to the criteria described herein.

# 1. INTRODUCTION

## 1.1 Purpose

This document establishes Test Criteria for measuring and determining NSIF 1.01 standards compliance for implementations that support a common environment to exchange digital imagery and imagery-related products between coalition members/communities.

## 1.2 Scope

This document describes the test criteria necessary for an NSIF implementation to conform to the latest edition of the NSIF document (STANAG 4545). The criteria within this document adhere to the file format constraints established in the latest ISO/IEC BIIF PROFILE for NSIF.

## 1.3 Background

Through extensive coordination with the NATO STANAG 4545 Custodian and its technical working group, this NSIF 1.01 test criteria document is developed to identify NSIF 1.01 testable criteria and is focused on establishing digital imagery exchange interoperability.

# 2. REFERENCES

## 2.1 Policy and Planning Documents

2.1.1 North Atlantic Treaty Organization (NATO) ISR Interoperability Architecture (NIIA) Test and Evaluation Program Plan, AEDP-2, Volume 2, Annex B, September 2005

## 2.2 NATO Standardization Agreements (STANAGs)/Allied Publications (APs) /Related Documents

(Note: Copies of STANAGs can be obtained from NATO Central Registries in each nation.)

2.2.1 ISO/IEC BIIF PROFILE NSIF 01.01, June 2008

2.2.2 ISO/IEC BIIF Profile for JPEG 2000 Version 01.10 (BPJ2K01.10), 15 April 2009

2.2.3 STANAG 4545, North Atlantic Treaty Organization; Edition 2, 5 December 2010

2.2.4 STANAG 7074, DIGEST, Digital Geographic Information Exchange Standard (DIGEST) AGeoP-3A, Edition 2.0, June 1997

2.2.5 STANAG 1059, Letter Codes For Geographical Entities, Edition 8, 19 February 2004

2.2.6 Allied Engineering Documentation Publication – 2 (AEDP-2), NATO Imagery Interoperability Architecture, September 2005

2.2.7 NATO NSIF Registry, latest update as posted at: http://www.nato.int/structur/AC/224/standard/4545/4545.htm.

## 2.3 International Standards (IS)

2.3.1 ISO/IEC 3166; Codes for the representation of names of countries and their subdivisions:

2.3.2 ISO/IEC 8632-1:1999, Information Technology - Computer graphics metafile for the storage and transfer of picture description information - Part 1: Functional Specification

2.3.3 ISO/IEC 8632-3:1999, Information Technology - Computer graphics metafile for the storage and transfer of picture description information - Part 3: Binary encoding, 1999

2.3.4 ISO/IEC 10646-1:2000, Information technology - Universal multiple-octet coded character set (UCS) - Part 1: Architecture and basic multilingual plane

2.3.5 ISO/IEC 10918-1:1994, Information technology - Digital compression and coding of continuous-tone still images: Requirements and guidelines, 1994

2.3.6 ISO/IEC 10918-2:1995, Information technology - Digital compression and coding of continuous-tone still images: Compliance Testing, 1995

2.3.7 ISO/IEC 10918-3:1997, Information Technology; Digital Compression and Coding of Continuous-Tone Still Images; Extensions, 01 May 1997

2.3.8 ISO/IEC 12087-1:1995, Information technology--Computer graphics and image processing--Image processing and Interchange--Functional specification Part 1: Common architecture for imaging, 15 April 1995.

2.3.9 ISO/IEC IS 12087-5, Information technology - Computer graphics and image processing - Image processing and interchange (IPI) - Functional specification - Part 5: Basic image interchange format (BIIF), 1998

2.3.10 ISO/IEC 15444-1:2000 - Information technology - JPEG 2000 image coding system - Part 1: Core Coding System

2.3.11 ISO/IEC 15444-1-AMD1 - Information technology - JPEG 2000 image coding system - Part 1: Core Coding System, Amendment 1

2.3.12 ISO/IEC 15444-1-AMD2 - Information technology - JPEG 2000 image coding system - Part 1: Core Coding System, Amendment 2

2.3.13 ISO/IEC 15444-4:2002 - Information technology - JPEG 2000 image coding system - Part 4: Image Coding System: Conformance testing

2.3.14 ITU T.4 (1993:03), Terminal Equipment and Protocols for Telematic Services - Standardization of Group 3 Facsimile Apparatus for Document Transmission, AMD2 04/99

2.3.15 ISO/IEC, BIIF PROFILE; BPCGM01.00; Information Technology; Computer Graphics and Image Processing; Registered Graphical Item; Class: BIIF Profile; BIIF Profile for Computer Graphics Metafile, Version 01.00 (BPCGM01.00), dated 28 April 2004
(Note: This BIIF Profile for CGM is a profile using the CGM proforma, intended to be used in BIIF applications.)

2.3.16 ISO/IEC 80000 Quantities and units This ISO is used for extended values for the DIGEST and other TREs

(Copies of the above documents can be obtained from the national standards agencies or via the World Wide Web at http:\\www.iso.org/iso/en/prods-services/ISOstore/store.html.).

2.4. Federal Information Processing Publications

2.4.1 FIPS PUB 10-4, Countries, Dependencies, Areas of Special Sovereignty, and Their Principal Administrative Divisions, April 1995.

Note: On September 2, 2008, FIPS 10-4 was withdrawn by NIST as a Federal Information Processing Standard. For more information on the status of this activity, contact the STANAG 4545 custodian.

2.5. Military Standards (MIL-STDs) and Handbooks (HDBKs)

2.5.1 MIL-STD-2500C, National Imagery Transmission Format for the National Imagery Transmission Format Standard, 01 May 2006

2.5.2 MIL-STD-188-196, Bi-Level Image Compression for the National Imagery Transmission Format Standard, 18 June 1993 with Notice 1, 27 June 1996 (Note: This standard is being inactivated and the 4545 CST has recommended that future implementations should not incorporate this data compression algorithm into their systems.)

2.5.3 MIL-STD-188-198A, Joint Photographic Experts Group (JPEG) Image Compression, 18 June 1993

2.5.4 MIL-STD-188-199, Vector Quantization Decompression for the National Imagery Transmission Format Standard, 27 June 1994 with Notice 1, 27 June 1996

(Copies of the above MIL-STDs are available from the Standardization Document Order Desk, 700 Robbins Avenue, Building 4D, Philadelphia, PA 19111-5094.)

2.6. NGA Specifications and Publications

2.6.1 N-0105, National Imagery Transmission Format Standard (NITFS) Standards Compliance and Interoperability Test and Evaluation Program Plan

2.6.2 N-0106, National Imagery Transmission Format Standard (NITFS) Bandwidth Compression Standards and Guidelines

2.6.3 STDI-0002; The Compendium of Controlled Extensions (CE) for the National Imagery Transmission Format (NITF), Version 4.0, 01 August 2011

2.6.4 STDI-0005, Implementation Practices of the National Imagery Transmission Format Standard (IPON), version 1.0, 01 August 2007. Note: Version 2.0 is currently in development.

(The US NGA publications listed above are available on the web at www.gwg.nga.mil/ntb/baseline/toc.html. Requests for copies of US NGA Specifications and Publications that are not available on the web may be made to the National Geospatial-Intelligence Agency, Attn:

National Center for Geospatial-Intelligence Standards, NCGIS L-66, 3838 Vogel Road, Arnold, Missouri 63010-6238 USA)

## 3. APPLICABILITY

This document is applicable for implementations that exchange digital secondary imagery and imagery related products between implementations of NSIF that require STANAG compliance testing.

# 4. ACRONYMS, TERMS AND DEFINITIONS.

## 4.1 Acronyms

**Table C-1. Acronyms**

| *Acronym* | *Meaning* |
|---|---|
| ACCESSID | Access ID |
| AEDP | Allied Engineering Documentation Publication (a form of AP) |
| ALVL | Attachment Level |
| ANSI | American National Standards Institute |
| AP | Allied Publication |
| BCS-A | Basic Character Set – Alphanumeric |
| BCS-N | Basic Character Set – Numeric |
| BIIF | Basic Image Interchange Format (ISO standard) |
| bpp | Bits Per Pixel |
| CCS | Common Coordinate System |
| CGM | Computer Graphics Metafile |
| CLEVEL | Complexity Level |
| COD | Coding Style Default Marker |
| COMRAT | Compression Rate Code |
| CPRL | Component Position Resolution Layer |
| DCT | Discrete Cosine Transform (image compression) |
| DES | Data Extension Segment |
| DIGEST | Digital Geographic Information Exchange Standard |
| DLVL | Display Level |
| DTED | Digital Terrain Elevation Data |
| DTEM | Digital Terrain Elevation Matrix |
| DWT | Discrete Wavelet Transform |
| ECS-A | Extended Character Set – Alphanumeric |
| EOC | End Of Codestream |
| EPJE | Exploitation Preferred JPEG 2000 Encoding |
| ETS | Executable Test Suite |
| FBKGC | File Background Color (field) |
| FIPS | Federal Information Processing Standard (US standard) |
| GMTI | Ground Moving Target Indication |
| IC | Image Compression |
| ICAT | Image Category (field) |
| ICS | Implementation Compliance Statement |
| IDWT | Inverse Discrete Wavelet Transform |
| IEC | International Electrotechnical Commission |
| ILOC | Image Location |
| IMODE | Imagery Mode |
| IREP | Image Representation (field) |
| IS | International Standard |
| ISO | International Organization for Standardization |

| *Acronym* | *Meaning* |
|---|---|
| ISR | Intelligence, Surveillance, and Reconnaissance |
| ITU | International Telecommunications Union |
| IUT | Implementation Under Test |
| J2K | JPEG 2000 |
| JP2 | JPEG 2000 minimal interchange format |
| JPC | JPEG Codestream |
| JPEG | Joint Photographic Experts Group (image compression) |
| JPX | JPEG 2000 XML based file format |
| LPJE | Large Volume Streaming Data (LVSD) Preferred JPEG 2000 Encoding |
| LRCP | Layer Resolution Component Position |
| LUT | Look Up Table |
| MGRS | Military Grid Reference System |
| MIL-STD | Military Standard (US) |
| MTF | Message Text Format |
| NAD | North American Datum |
| NATO | North Atlantic Treaty Organization |
| NBN | NITFS/BIIF/NSIF, NSIF/BIIF/NITFS |
| NBPC | Number of Blocks Per Column |
| NBPP | Number of Bits Per Pixel (field) |
| NBPR | Number of Blocks Per Row |
| NCOLS | Number of Columns |
| NGA | National Geospatial-Intelligence Agency (US) |
| NIIA | NATO ISR Interoperability Architecture |
| NITF(S) | National Image Transmission Format (Standard)  (US standard) |
| NPJE | NSIF Preferred JPEG 2000 Encoding |
| NPPBH | Number of Pixels Per Block Horizontal |
| NPPBV | Number of Pixels Per Block Vertical |
| NROWS | Number of Rows |
| NSIF | NATO Secondary Imagery Format |
| OSTAID | Originating Station ID |
| PC | Personal Computer |
| PCRL | Position Component Resolution Layer |
| PLM | Packet Length, in Main header |
| PLT | Packet Length, in Tile-part header |
| QCD | Quantization Default Marker |
| RES | Reserved Extension Segment |
| RGB | Red-Green-Blue |
| RGN | Region of Interest |
| RLCP | Resolution Layer Component Position |
| RPCL | Resolution Position Component Layer |
| SDE | Support Data Extension |
| SIZ | Image and Tile Size Marker |
| SOC | Start of Codestream Marker |
| SOD | Start of Data Marker |
| SOT | Start of Tile-part Marker |
| SPJE | STANAG 7023 Preferred JPEG 2000 Encoding |
| Ssiz | Precision in bits |

| *Acronym* | *Meaning* |
|---|---|
| STANAG | NATO Standardization Agreement |
| SUT | System Under Test |
| TBD | To Be Determined |
| TBR | To Be Revised |
| TLM | Tile-part Length Markers |
| TPJE | Tactical Preferred JPEG 2000 Encoding |
| TRE | Tagged Record Extension |
| UPS | Universal Polar Stereographic |
| UTM | Universal Transverse Mercator |
| VQ | Vector Quantization (image compression) |
| WGS | World Geodetic System |
| XOsiz | Horizontal offset from the origin of the reference grid to the left side of the image area |
| XRsiz | Horizontal separation of samples with respect to the reference grid |
| Xsiz | Width of the reference grid |
| XTsiz | Width of one reference tile with respect to the reference grid |
| YCbCr | Y=Brightness of signal, Cb=Chrominance (blue), Cr=Chrominance (red), color space |
| YOsiz | Vertical offset from the origin of the reference grid to the top side of the image area |
| YRsiz | Vertical separation of samples with respect to the reference grid |
| Ysiz | Height of the reference grid |
| YTsiz | Height of one reference tile with respect to the reference grid |

## 4.2. Terms and Definitions

The following terms and definitions are used in this document and/or the NSIF community:

### 4.2.1 Attachment Level

A field value of a segment that indicates the display level of the segment to which it is attached. It provides a way to associate images and symbols as a group for the purpose of moving, rotating or displaying.

### 4.2.2 Annotational Text

Text placed on or adjacent to an image as a graphic symbol to provide a textual overlay to the image. (Same as Symbol Text.)

### 4.2.3 Band

One of the two-dimensional (row/column) arrays of pixel sample values that comprise an image. For the basic use of NSIF, the band values are homogeneous data types for each band. In the case of monochrome or indexed color images (single 2 dimensional array of pixel values with possible look-up-tables), the image array consists of one band. In the case of RGB images (three 2-dimensional arrays of pixel values where each array holds the value for one of the 3 colors; the same number of bits each of Red, Green and

Blue values for each pixel), the image consists of using the three bands wherein the representation of each band is specified by the value in IREPBANDn.

4.2.4 Basic Character Set (BCS)
A subset of ISO/IEC 10646-1 character set which is represented by the UTF-8 form and used in headers and subheaders.

4.2.5 Basic Character Set-Alphanumeric (BCS-A)
A subset of the Basic Character Set. The range of allowable characters consists of space through tilde (single octets with values ranging from 0x20 to 0x7E) from the Basic Latin Collection.

4.2.6 Basic Character Set-Numeric (BCS-N)
A subset of the Basic Character Set which consists of the digits “0” through “9”, “plus sign” , “minus sign” , “decimal point” , and “slash”.

4.2.7 Block
A rectangular array of pixel values which is a subset of an image. An image consists of the union of one or more non-overlapping blocks.

4.2.8 Byte
A byte is defined as equivalent to an octet.

4.2.9 Cclass
Three Compliance Classes are defined in Annex A of ISO/IEC WD15444-4:2002. These Cclasses define level of image quality guarantees for decoders and guidance for encoders to produce J2K Codestreams.

4.2.10 Common Coordinate System (CCS)
The virtual row and column coordinate space against which all NSIF file components are ultimately referenced. The locations of NSIF components with attachment level of zero are referenced to the origin of the Common Coordinate System. The extent of the common coordinate system is defined by the complexity level designation.

4.2.11 Conditional
An adjective applied to data fields whose existence depends on the value of the designated Required field preceding the Conditional field.

4.2.12 Coordinated Universal Time (UTC)
The time scale maintained by the Bureau International de L'Heure (International Time Bureau) that forms the basis of a coordinated dissemination of standard frequencies and time signals. UTC is equivalent to the mean solar time at the prime meridian at Greenwich, England.

4.2.13 Decode
To create or construct an image array or dataset from a compressed (e.g., J2K) codestream.

4.2.14 DES
Data Extension Segment is a construct used to extend NSIF functionality with minimal impact on the underlying standard document. A type of extension segment with sub-header and data fields structured similarly to the standard data types in the NSIF file (e.g., image, label, symbol, text). A DES may be incorporated into an NSIF file while maintaining backward compatibility. The data extension identifier

and byte count mechanisms allow applications developed prior to the addition of newly defined data, to skip over extension fields that they are not designed to interpret.

4.2.15 Digital Imagery System
The equipment and procedures used to collect, store, display, manipulate, analyze, annotate, exchange and/or transmit imagery and imagery products.

4.2.16 Displayable
Information that can be exhibited in visual form.

4.2.17 Display Level
A field value of a segment that denotes the order in which the segments (images and symbols) are “stacked”. The Display Level order is independent of the data sequence order in this format.

4.2.18 Encode
To create or construct a compressed (e.g., J2K) codestream from a given image array or data set.

4.2.19 Exploitation System
Systems with functional requirements to analyze, exploit, and extract information from digital imagery to produce an exploited imagery product.

4.2.20 Field
Logically primitive item of data, sometimes referred to as an attribute.

4.2.21 Fielded System
A system that has been approved for use and/or production.

4.2.22 Image
A representation of physical visualization, for example, a picture. An image is the computer (digital) representation of a picture. An image is comprised of discrete picture elements called pixels structured in an orderly fashion consisting of pixel value arrays formatted using bands and blocks.

4.2.23 Implementation Under Test (IUT)
A candidate implementation of any portion of the NSIF suite of standards for which compliance testing is being performed. An implementation does not necessarily comprise a full imagery system.

4.2.24 Implementer
Programmer who develops or assembles software, which complies with NSIF features, requirements or constraints as described in this document and those listed in the Normative References section.

4.2.25 International Standardized Profile
An internationally agreed-to, harmonized document which identifies a standard or group of standards together with options and parameters necessary to accomplish a function or set of functions.

4.2.26 J2K Compliance
The ability of an implementation to create and output J2K compliant files and/or to accept and decode J2K files.

4.2.27 Look-Up Table (LUT)

A collection of values used for translating image samples from one value to another. The current sample value is used as an index into the look-up table(s); therefore, the number of entries in each look-up table for a single bit per pixel image would contain two entries and each look-up table for an 8-bit per pixel image would contain 256 entries. Multiple look-up tables allow for the translation of a scalar pixel value to an n-dimensional vector pixel value.

4.2.28 Non-blank

Non-blank indicates that the field cannot be filled entirely by the BCS-A space character (0x20). It may contain space characters when included with other characters.

4.2.29 NSIF Compliance

The ability of an NSIF implementation to create and output NSIF compliant Files and/or to accept NSIF files and recognize the component parts as prescribed in the NSIF Test Criteria document.

4.2.30 NSIF Component Compliance

A statement indicating that a hardware or software component (as opposed to a full implementation) passed compliance testing to a specific subset of NSIF Compliance Criteria.

4.2.31 Native Mode

The intrinsic attributes and operational mode of an imagery system. When an imagery system's architecture, design, and/or internal representation for images, graphics, text, and/or other data is not in accordance with the NSIF, its native mode is considered to be other than NSIF.

4.2.32 NATO Secondary Imagery Format (NSIF)

NSIF is the imagery file format contained in STANAG 4545. The term usually inherits the context of the latest NSIF version when the version is not specifically identified.

4.2.33 National Imagery Transmission Format (NITF)

NITF is the imagery file format contained in MIL-STD-2500A (NITF 2.0), and MIL-STD-2500C (NITF 2.1).

4.2.34 National Imagery Transmission Format Version 2.1 (NITF 2.1)

The third NITF implementation version (MIL-STD-2500C). N-0105/98, NITFS Standards Compliance and Interoperability Test and Evaluation Program Plan, describes NITF 2.1 compliance requirements.

4.2.35 NATO Secondary Imagery Format Version 1.01 (NSIF 1.01)

The second NSIF version. The North Atlantic Treaty Organization (NATO) ISR Interoperability Architecture (NIIA) Test and Evaluation Program Plan establishes the formal compliance Test Program for NSIF 1.01.

4.2.36 Octet

An octet is defined as 8 bits.

4.2.37 Pack

To create or construct an NSIF file within the set of conditions and constraints defined for compliance with NSIF 1.01.

4.2.38 Pad Pixel

A pixel with sample values that have no significant meaning to the image. Pad pixels are used with block images when either the number of pixel rows in an image is not an integer multiple of the desired number of vertical image blocks, or when the number of pixel columns in an image is not an integer multiple of the desired number of horizontal image blocks.

4.2.39 Pad Pixel Mask
A data structure which identifies recorded/transmitted image blocks which contain pad pixels. The pad pixel mask allows applications to identify image blocks which require special interpretation due to pad pixel content.

4.2.40 Pixel
An abbreviation for the term “picture element”.

4.2.41 Production System
A system with functional requirements to generate digital imagery from sensor sources.

4.2.42 Profile
A set of one or more base standards, and where applicable, the identification of chosen classes, subsets, options, and parameters of those base standards, necessary for accomplishing a particular function.

4.2.43 Profile Variant
A field within this basic standard that is allowed to be defined by a profile for its structure and intent (content). An element or an attribute that is allowed to differ between profiles.

4.2.44 Required
An adjective applied to data fields that must be present and filled with valid data or default data.

4.2.45 RES
The Reserved Extension Segment (RES) construct provides the same mechanism as the DES construct for adding new data types for inclusion in NSIF files. However, the RES is reserved for data types that need to be placed at or near the end of the file.

4.2.46 Sample
One element in the image array that comprises an attribute of the image. In NSIF, a sample (pixel vector value) is indexed according to the row and column of the array where it appears.

4.2.47 SDE
A Support Data Extension (SDE) is a collection of one or more Tagged Record Extensions (TREs) that form a logical functional group.

4.2.48 SAR
Image obtained from a synthetic aperture radar.

4.2.49 SARIQ
Radio hologram (initial phase information) from a synthetic aperture radar.

4.2.50. Secondary Imagery Dissemination System (SIDS)
The equipment and procedures supporting the process of post-collection electronic dissemination of Command, Control, Communications, Computers and Intelligence ($C^4I$) data, over a time interval ranging from near-real-time to a period of days, at a quality level determined by receiver requirements.

4.2.51 System Under Test (SUT)

A candidate imagery system for which NSIF compliance testing is being performed.

4.2.52 Symbol
A pictorial element that may be aligned with a point in or adjacent to an image to provide graphical markings and/or textual labels.

4.2.53 Symbol Text
Text placed on or adjacent to an image as a graphic symbol to provide a textual overlay to the image.

4.2.54 Tagged Record Extension (TRE)
A means to provide additional attributes about standard data segments not contained in the standard header or sub-header fields. Also know as a TAG.

4.2.55 Transparent Pixel
A pixel whose sample values must be interpreted for display such that the pixel does not obscure the display of any underlying pixel.

4.2.56 Unpack
To interpret and make appropriate use of the imagery, data, and associated information contained in an NSIF file. In most instances, this includes the capability to accurately display and/or print the contents of an NSIF file.

4.2.57 YCbCr
Technique for specifying color images where Y = Brightness of signal, Cb = Chrominance (blue), Cr = Chrominance (red)

# 5. NSIF COMPLIANCE CRITERIA

## 5.1 General

### 5.1.1 NSIF Compliance Criteria
The NSIF Compliance Criteria are derived from ISO/IEC BIIF Profile NSIF01.01 and associated standards and specifications identified herein. The NSIF Profile and related documents fully describe the NSIF file components, features, allowable field values, formats, and field lengths. Since NSIF is very flexible and has many options, constraining those options to an operational sub-set for implementation is the key to achieving NSIF file exchange interoperability. The criteria in this document identifies the features, capabilities, formats, field values, ranges, and associated boundary conditions of NSIF against which an implementation is tested for compliance.

### 5.1.2 Pack/Unpack
For the purposes of this Test Criteria Document, the term "pack" refers to the creation or construction of an NSIF file within the set of conditions and constraints defined for compliance with the NSIF. The term "unpack" refers to the interpretation and proper display of imagery, graphics, text data, and metadata within the NSIF file. In most instances, this includes the capability to accurately display and/or print the contents of an NSIF file. A compliant implementation may have a pack-only capability, an unpack-only capability, or both a pack and unpack capability.

5.1.3 Compliance Principles

The NSIF Compliance Criteria contained herein are intended to strike a balance between fully implementing all the requirements in the standards and the planned operational requirements of the actual system(s) implementing the standard. The history of imagery implementations is replete with examples of implementations deployed for use in environments for which they were not originally intended to operate. This fact drives the need to establish baseline requirements from the standards that are applicable to all implementations regardless of perceived operational requirements. Where clear architectural guidance exists, the applicable test criteria for the required services and features will be selected from among the criteria established in this document. The cardinal principles are:

5.1.3.1 The packing implementation shall ensure all produced NSIF files are NSIF compliant and within the bounds of the established "Complexity Levels" (CLEVELs). Packing systems will only be tested to the NSIF features supported.

5.1.3.2 When an implementation also supports unpacking (interpret/process), it must be capable of properly unpacking (and portraying, when applicable) any file that it is able to pack. The unpacking implementation shall ensure the information/data from NSIF files is presented as the originator intended, at least for the fundamental segments (image, graphic, and text) of the NSIF file.

5.1.3.3 Unpack capable systems must interpret and properly portray all features addressed by the complexity level (CLEVEL) identified for the implementation, with the exception of those features identified as optional for implementation within Table D-1 of ISO/IEC BIIF Profile NSIF 01.01 of this document.

5.1.3.4 When unpacking NSIF files with unrecognized content (e.g., content that cannot be properly interpreted or presented by the implementation, for example corrupted or unsupported extension data), the implementation shall provide a means to alert the system operator or administrator that the file(s) has unrecognized content in addition to what is being presented or interpreted. The implementation must continue to unpack and portray the content that is recognized (supported).

5.1.4 Native Mode Rule

The native mode rule refers to the requirement that those implementations offering features or attributes in their native mode of operation that directly correlate with features defined in NSIF 1.01 (such as supporting the creation of graphic annotation) must also support those features and attributes in accordance with NSIF.

5.2 NSIF Complexity Level (CLEVEL)

NSIF implementations are tested according to their ability to pack and/or unpack various CLEVELs of NSIF files. This concept allows NSIF implementation on a wide range of hardware platforms with various levels of internal resources, while maintaining a baseline level of interoperability between all compliant registered systems. NSIF 1.01 defines five CLEVELs: 03, 05, 06, 07, and 09. Table D-1 of ISO/IEC BIIF Profile NSIF 01.01 contains a summary of the compliance criteria of each CLEVEL. NSIF files shall be marked at the lowest CLEVEL for which they qualify.

5.2.1 NSIF Feature Summary

Table D-1 of ISO/IEC BIIF Profile NSIF 01.01 defines the conditions of NSIF file features used to determine the CLEVEL assignment for a given NSIF file. The seven key NSIF file features which differentiate CLEVELs are: CCS extent, NSIF file size (bytes), image size (row/column), image blocking, number of multispectral bands, number of Image Segments per NSIF file, and aggregate size of graphic segments. The other listed features provide the parameter, value, range conditions, and constraints for all the defined CLEVELs. Although an NSIF file shall be marked at the lowest CLEVEL for which it qualifies, it must be marked no lower than the highest CLEVEL feature condition included in the NSIF file. For example, a 51 Megabyte (Mbyte) NSIF file must be marked at CLEVEL 05, even though all other features in the NSIF file do not exceed CLEVEL 03 conditions.

## 5.3 Elements of NSIF Compliance

### 5.3.1 Overview

Table D-1 of ISO/IEC BIIF Profile NSIF 01.01 contains the NSIF Compliance Criteria for general reference; the specific features and compliance test requirements are described in the remainder of this chapter with additional details in the attachments to this Annex. Specific NSIF file header and subheader field values, ranges, and boundary conditions required for NSIF compliance are identified in ISO/IEC BIIF Profile NSIF 01.01 Annex C and Appendices 1. They also contain the specific test conditions for supported image compressions and Computer Graphic Metafile (CGM) annotations. Criteria for imagery applications that requiring the support of the NITF 2.0 file format will comply with NGA document N-0105.

### 5.3.2 Complexity Level (CLEVEL) Ranges

Unpack applications shall be able to fully interpret any compliant NSIF file within the supported CLEVEL. Table D-1 of ISO/IEC BIIF Profile NSIF 01.01 provides an overview summary of compliance criteria. The following further defines the proper interpretation of the table.

#### 5.3.2.1 CLEVEL 09

CLEVEL 09 is used to designate NSIF 1.01 files that exceed the CLEVEL 07 constraints in Table D-1 of ISO/IEC BIIF Profile NSIF 01.01 but remain within the bounds of STANAG 4545. CLEVEL 09 designates that the file exceeds one or more of the following CLEVEL 07 constraints:

- Maximum File Size (greater than 10 Gbytes),
- Block size greater than 8192 pixels,
- More than 999 Bands,
- More than 100 images,
- More than 100 graphics segments,
- Graphic aggregate size exceeds 2 Mbytes,
- Number of Text Segments exceeds 32, and /or
- The number of DES exceeds 10.

## 5.4 NSIF Compliance Test Functional Requirements

### 5.4.1 NSIF Pack

The following are NSIF pack compliance test functional requirements. A pack implementation is an application required to generate an NSIF 1.01 file.

5.4.1.1 A pack implementation must be able to pack NSIF compliant files within the constraints of the CLEVEL file types for which compliance is desired. At a minimum, an implementation must support packing the NSIF CLEVEL features corresponding with those available in its native mode of operation. For example, if the native mode supports annotations using graphics, the implementation must support graphic annotations according to NSIF.

5.4.1.2 For systems that include an image capture or input device, the pack implementation must support the CLEVELs of the image size(s) that can be captured as well as images represented (IREP). Additionally, it must support the boundary conditions of the supported CLEVEL.

5.4.1.3 A pack implementation is not required to implement all NSIF file features available at any particular CLEVEL. The set of pack features implemented is somewhat at the discretion of the implementation's Sponsor. It is the responsibility of those acquiring or intending to use a particular implementation to ensure that the needed packing features are present. Whatever set of features are implemented; they must be done within the constraints of the appropriate CLEVEL and will be thoroughly tested.

5.4.1.4 An implementation that packs an NSIF file must have a means to ensure that the NSIF file meets the specific CLEVEL intended and does not exceed the boundary conditions for that CLEVEL file type.

5.4.2. NSIF Unpack

The following are NSIF unpack compliance test functional requirements. An unpack implementation is an application required to interpret an NSIF file

5.4.2.1 An implementation must be able to unpack any NSIF compliant file at the CLEVEL for which compliance is being tested. It must also unpack any NSIF file packed at a lesser CLEVEL. Hence, there is a stringent requirement for an unpacker to be robust enough to handle all NSIF file features (even if it cannot pack the feature) invoked by any packing implementation of an equal CLEVEL or below.

5.4.2.2 An implementation attempting to unpack an NSIF file packed at a higher CLEVEL may do its best to properly interpret and use the NSIF file. Upon detecting the unsupported CLEVEL of the NSIF file, the implementation must at least alert the system operator of the event and provide the option to abort continuation of the unpack process. This must be accomplished without adversely disrupting the system operation (such as requiring a system re-boot or re-initialization of the system). If the application allows the operator the option to proceed with the unpack operation, the operator must be alerted to the potential for disruption of operation and potential incompleteness of any resulting presentation.

5.4.2.3 As long as the Segment offset lengths in the NSIF file Header are accurate, the implementation must be able to skip past incorrect segments and any segments containing non-supported optional features or attributes. The implementation must otherwise properly interpret remaining NSIF file Segments. The operator must be notified about segments which cannot be properly interpreted

5.4.3 Nested CLEVELs

All NSIF implementations must be capable of performing the basic NSIF file processing functions associated with each CLEVEL below that for which it is tested. All unpack implementations must be able to unpack any lower CLEVEL compliant NSIF file. All pack implementations must mark NSIF files at the lowest CLEVEL that supports unpacking of the NSIF file, regardless of the maximum CLEVEL capability of the packing implementation. Generally, a pack implementation should be able to pack NSIF files of each CLEVEL below which it is capable in order to interchange NSIF files with other implementations of lower CLEVELs. When so required by the system sponsor, the system must be able to pack NSIF files at each lower CLEVEL with contents that do not exceed the boundary conditions for each respective CLEVEL.

5.4.4 Common Coordinate System (CCS)

One of the differences between CLEVELs in Table D-1 of ISO/IEC BIIF Profile NSIF 01.01 is the CCS size constraint. These constraints define the boundary rectangle of the combined displayable segments (image and graphic) contained within an NSIF file for each respective CLEVEL. All pack capable implementations must constrain the size and location, of displayable elements within the boundary of the respective CLEVEL of the NSIF file being packed. All unpack capable implementations must support the full extent of the CCS size of the CLEVELs for which compliance is sought and apply the background color as specified by the originator of the file.

5.4.5 JPEG Compression

5.4.5.1 JPEG Discrete Cosine Transform (DCT) Compression

All unpack capable implementations must support JPEG decompression using the Discrete Cosine Transform (DCT), Huffman Entropy Encoding, and 8-bit and 12-bit precision mode of operation. Implementations must support the use of restart markers in the compressed data. Similarly, all pack capable implementations with the requirement to support JPEG compression must implement JPEG DCT using the specifications and guidance contained within AEDP 2 Volume 4 Annex A, and do so within the bounds of the criteria established for unpacking. NOTE: This is not the same as public JPEG DCT. This is a superset of the public version such that a public reader or writer will not be able to handle the NSIF JPEG DCT data stream.

5.4.5.2 Downsampled JPEG

All unpack capable implementations must support all features of Downsampled JPEG decompression. All pack capable implementations with requirements to support Downsampled JPEG compression must only pack these types of imagery segments within the bounds of the NSIF Compliance Criteria established for unpacking. All Downsampled JPEG imagery will be single band and single block, no larger than 2048 pixels per row and per column. (Note: These are constraints imposed by the Downsampled JPEG specification.)

5.4.5.3 Lossless JPEG

Unpack capable systems may optionally support Lossless JPEG decompression. Pack capable implementations with requirements to support Lossless JPEG compression must only pack these type of Image Segments within the bounds of the NSIF Compliance Criteria established for unpacking

5.4.5.4 JPEG 2000

All unpack capable implementations must support all features of JPEG 2000 decompression, ISO/IEC IS 15444-1 Part 1. All pack capable implementations with requirements to support JPEG 2000 compression must only pack these types of imagery segments within the bounds of the NSIF Compliance Criteria established for unpacking. See ISO/IEC BIIF Profile BPJ2K01.10 Appendix A for the specific details on the criteria for the procedures that are required to utilize the functionality of JPEG 2000.

5.4.6 Bi-Level Compression

All unpack capable implementations that have a requirement, may support Bi-Level decompression using the Huffman Entropy Encoding. Unpack capable implementations must support unpacking in all three modes: one-dimensional coding (1D), two-dimensional coding with standard vertical resolution (2DS), and two-dimensional coding with high vertical resolution (2DH). Pack capable implementations with requirements to support Bi-Level compression, shall do so within the bounds of the criteria established for unpacking. All Bi-Level compressed Image Segments will be single band and single blocked. (Note: This encoding is being inactivated and the 4545 CST has recommended that future pack implementations should not incorporate this data compression algorithm into their systems.)

5.4.7 Vector Quantization (VQ) Compression

All unpack capable implementations, that have a requirement, must support VQ decompression and must comply with the specifications and guidance contained within MIL-STD-188-199 and the criteria established for unpacking. Pack capable implementations, with requirements to support VQ compression, must only pack VQ compressed Image Segments within the bounds of the criteria established for unpacking. Producers of VQ compressed Image Segments are solely responsible for the means of generating code tables resulting in appropriate quality of the decompressed imagery.

5.4.8 CGM Graphics

All implementations must support unpacking NSIF files that contain CGM graphic segments. Those implementations that support annotations using graphics in their native mode must support packing of CGM graphic segments. ISO BIIF Profile for Computer Graphics Metafile, Version 01.00 (BPCGM01.00) describes the applicable profile for CGM.

5.4.9 Bit-Mapped Graphics (Symbols)

The use of bit-mapped symbols within a graphic segment is limited to legacy NITF 2.0 file. NSIF 1.01 pack capable implementations supporting graphics must only use CGM formatted graphics. NSIF systems may support bit-mapped symbology as a 1-bit monochrome image segment only. Compatibility with NITF 2.0 will only be tested if the NSIF 1.01 application developer identifies a requirement.

5.4.10 Monochrome

All unpack capable implementations must support the unpacking of monochrome images with the following Number of Bits-per-pixel (NBPP) pixel depths: 1, 8, 12, 16, 32 and 64 bits-per-pixel. All pack capable implementations with the requirement to pack monochrome image data must do so within the bounds of the criteria established for unpacking. (See Table D-1 NSIF01.01)

5.4.11 Color

All unpack capable implementations must support the unpacking and display of color Image Segments. (The display device does not need to be a color display.) Both single band with Look-Up-Table (LUT), and three-band must be supported. All pack capable implementations with the requirement to pack color image data must do so within the bounds of the criteria established for unpacking. (See Table D-1 NSIF01.01)

5.4.12 Multiband

All unpack capable implementations must support the unpacking and display of Multiband Image Segments containing up to nine bands for CLEVEL 3 NSIF implementations, 255 bands for CLEVELs 5 and 6, and 999 bands for CLEVEL 7 NSIF implementations. For Multiband image files containing more than 999 bands the CLEVEL will be 09. All pack capable implementations with requirements to pack Multiband Image Data must do so within the bounds of the criteria established for unpacking. (See Table D-1 NSIF01.01)

5.4.13 No display (NODISPLY) Image Representation

Unpack capable implementations may optionally support Image Segments with matrix data having an Image Representation (IREP) of No Display (NODISPLY). When supported, the implementation must pass the data field content to the appropriate matrix data application for further processing according to the value contained in the Image Category (ICAT) field. Implementations without a requirement to support NODISPLY matrix data must not be adversely affected when Image Segments containing such data are encountered. At the very least, the operator must be notified about segments that cannot be properly interpreted. Pack capable implementations with requirements to support the NODISPLY representation of matrix data must do so within the bounds of the criteria established for unpacking.

5.4.13.1 Elevation Data

Unpack capable implementations may optionally support exploitation of elevation matrix data contained within an image segment. Those systems that have chosen to implement this feature must do so in accordance with the criteria detailed in paragraph 5.6.1.9. In general, when an NSIF file contains an Image Segment with pixel data, a corresponding image segment with elevation data, and the appropriate Geospatial Support Data Extension (GeoSDE), the NSIF implementation must be able to indicate the elevation for all pixels within the image pixel array that have elevation data associated with them. The implementation must present the elevation with an accuracy equal to the accuracy given in the GeoSDE. All pack capable implementations with the requirement to pack elevation data must do so within the bounds of the criteria established for unpacking.

5.4.13.2 Location Grid Data

Unpack capable implementations may optionally support exploitation of location grid data contained within an image segment. Those systems that have chosen to implement this feature must do so in accordance with the criteria detailed in paragraph 5.6.1.10. In general, if an NSIF file contains an Image Segment with pixel data, a corresponding image segment with location grid data, and the appropriate GeoSDE, the NSIF implementation must be able to indicate the location coordinates for all pixels within the image pixel array that have location data associated with them. The implementation must also present the associated accuracy information given in the GeoSDE. All pack capable implementations with the requirement to pack location grid data must do so within the bounds of the criteria established for unpacking.

5.4.14 Image Data Mask

All unpack capable implementations must properly interpret and use block and/or pixel mask tables. Unpack capable implementations must interpret and reconstruct the image upon display as called for by the masked tables. A pad pixel value of zero must be treated as transparent. A pad pixel value other than zero may be replaced with a user-defined value. Pad pixel values may be ignored in histogram generation. Pad pixels are not valid data and should not be used for interpretation or exploitation. Pack capable implementations that insert block and/or pixel mask tables must populate them with accurate offset and related values.

5.4.15 Tagged Record Extension (TRE)

Tagged Record Extensions (TREs, also known as TAGs) may appear in the User-Defined Header Data (UDHD), Extended Header Data (XHD), User-Defined Image Data (UDID), Image Extended Subheader Data (IXSHD), Graphic Extended Subheader Data (SXSHD), Text Extended Subheader Data (TXSHD) Fields, and the TRE_OVERFLOW DES regardless of CLEVEL. Only STANAG 4545 Custodian approved TREs are allowed as shown in the TRE portion of the NSIF Tagged Extension Registry. As a minimum, unpack capable implementations must at least ignore TREs and properly unpack the Segment in which the TRE exists. If the implementation supports the interpretation of TREs, it must also do so when the TREs happen to be located in a TRE_OVERFLOW DES. Table C-1-7 of ISO/IEC BIIF Profile NSIF 01.01 contains the TRE format. Supported TREs are tested in accordance with those identified in the Tag Extension Registry that can be found on the AGIV web site:
http://www.nato.int/structur/AC/224/standard/4545/NSIF_Approved_SDEs.htm

5.4.16 Data Extension Segment (DES)

Only STANAG 4545 Custodian approved DESs are allowed as shown in the DES portion of the NSIF Tagged Extension Registry. Presently, NSIF implementations are not required to interpret NSIF files containing the STREAMING_FILE_HEADER[§] or GMTI DES. If an implementation has a requirement to read STREAMING_FILE_HEADERS[§] or GMTI DES, then it will be tested for compliance.

Implementations that support the interpretation of TREs must support the TRE_OVERFLOW DES. As a minimum, unpack capable implementations must interpret and take action on supported TREs that reside in the TRE_OVERFLOW DES. They may ignore unsupported TREs that reside in the TRE_OVERFLOW DES. NSIF applications must continue to properly unpack other supported NSIF file segment(s) within the NSIF file.
(§ - The STREAMING_FILE_HEADER DES is now deprecated and should no longer be used. There are no know production systems that used this DES.)

5.4.17 Reserved Extension Segment (RES)
Only STANAG 4545 Custodian approved Reserved Extension Segments (RESs) are allowed as shown in the RES portion of the NSIF Tagged Extension Register. As a minimum, unpack capable implementations must at least ignore RES and properly unpack other supported NSIF file Segments.

5.4.18 Communications Channels
All systems, and/or components within a system, must support the exchange of NSIF files across whatever standard (ANSI, ISO, FIPS, Commercial, etc.) communication channel/protocol that is provided with the system/component. The NSIF file exchange capability supports the components within the system as well as between systems. The NSIF program does not include testing of communications channels. Coordinate alternate arrangements to establish appropriate communications channels testing.

5.4.19 Physical Exchange Media
Systems with exchangeable media capability intended for distribution or exchange of imagery products (e.g., magnetic disk, tape, optical disk, etc.) must be able to exchange NSIF files via that media. All systems must provide some means to exchange NSIF files for NSIF Compliance Testing purposes. Most systems have some type of media peripheral(s) to at least support system operation and maintenance. Coordinate alternative arrangements to complete NSIF Compliance Testing with the NSIF Test Facility personnel when this is not the case.

5.4.20 NITF 2.0 Files
All developers/sponsors of NSIF 1.01 unpack capable implementations that have identified a requirement to support the NITF 2.0 file format must be able to unpack any NITF version 2.0 compliant file that falls within the equivalent NSIF 1.01 CLEVEL definitions. All pack capable implementations with a specific requirement to pack NITF 2.0 formatted files must also support the capability to pack NITF files within the constraints of NITF version 2.0 that fall within the equivalent NSIF 1.01 CLEVEL structure.

5.4.21 Date and Time Fields
Date and time fields within an NSIF file often represent currency and sequence of information that is critical to the exploitation and interpretation of data. For those occasions when portions of the date and/or time entry are not obtainable or complete, the following convention will apply. Populate the unknown date/time two character subfield with two hyphen-minus characters (hexadecimal code "2D") indicating the portion of the date or time that is unknown. For example, populating a date and time field when the Century (CC), Year (YY), Month (MM) and Day (DD) are known, but the hour (hh), minute (mm), and second (ss) values are unknown, appears as: 20020425------. In another example such as a birthday of 14 Feb 47, where the CC is unknown or not expressed by the source of the information, the value would appear as: --470214.

5.5. NSIF 1.01 File Format Criteria – General.

5.5.1 Basic Character Set Alphanumeric (BCS-A) Fields

All fields designated for BCS-A character string information contained in the NSIF Header and Subheader fields must be given in the printable BCS-A character set [Space (0X20) to Tilde (0X7E)] with 8-bits (one byte) per character, the Most Significant Bit (MSB) always set to zero.

5.5.2 Basic Character Set Numeric (BCS-N) Fields

All fields designated for BCS-N character string information contained in the NSIF Header and Subheader fields must be given in the printable BCS-N character set [Numbers (0X30 to 0X39), plus the plus sign (0X2B), hyphen-minus (0X2D), full stop (0X2E), and solidus (0X2F)] with 8-bits (one byte) per character, the MSB always set to zero.

5.5.3 Basic Character Set Numeric Integer (BCS-N Integer) Fields

All fields designated for BCS-N integer character string information contained in the NSIF Header and Subheader fields must be given in the printable BCS-N integer character set [Numbers (0X30 to 0X39), plus the plus sign (0X2B), and hyphen-minus (0X2D)] with 8-bits (one byte) per character, the MSB always set to zero.

5.5.4 Basic Character Set Numeric Positive Integer (BCS-N Positive Integer) Fields

All fields designated for BCS-N positive integer character string information contained in the NSIF Header and Subheader fields must be given in the printable BCS-N positive integer character set [Numbers (0X30 to 0X39)] with 8-bits (one byte) per character, the MSB always set to zero.

5.5.5 Extended Character Set – Alphanumeric (ECS-A) Fields

Those NSIF Header and Subheader fields designated to allow the ECS-A character strings must contain characters within the Basic Multilingual Plane blocks Basic Latin and Latin-1 Supplement {0x20 to 0x7F and 0xA0 to 0xFF} with 8-bits (one byte) per character. Because of the inconsistencies between standards, users and implementers are advised that character codes ranging from 0xA0 to 0xFF shall never be used. Therefore, the use of ECS characters shall be restricted to its BCS subset.

NOTE: A general agreement within the NSIF community has been reached to not generate files with header values containing the ECS characters 0xA0 through 0xFF. However, implementations should be able to handle receiving files gracefully that contain the ECS characters outside this range.

5.5.6 Character Count Length

All length sizes or character counts given in NSIF Header and Subheader fields must specify the number of 8-bit bytes.

5.5.7 Alphanumeric Justification

All data in fields designated as alphanumeric (BCS-A, ECS, UT1, UT8, etc.) must be left justified and padded with Spaces as necessary to fill the field.

5.5.8 Numeric Justification

All data in numeric fields (BCS-N) must be right justified and padded with leading zeroes as necessary to fill the field. The following characters are allowed in numeric fields only when designated in the field range definition: Solidus (slant bar) (0x2F), plus sign (0x2B), hyphen-minus (0x2D), and full stop (decimal point) (0x2E).

5.5.9 File Background Color (FBKGC) Field

The File Background Color (FBKGC) field must contain unsigned binary integers expressing the background color in red, green, blue order.

NOTE: The value in the file background color is an unsigned binary integer and should not be identified as an UTF-8 character string. Implementers should be aware of this deviation from the ISO/IEC 12087-5, which identifies it as an UTF-8 character string.

5.5.10 Required Fields

All required fields must be present and must contain valid data within the specified ranges.

5.5.11 Conditional Fields

Conditional fields are present only if indicated by the value of one or more preceding fields. When a conditional field is present, it must contain valid data.

5.5.12 Row/Column Coordinates

Coordinates for Image and Graphic Segments must be given, as an ordered pair (r,c), where the first number (r) indicates the row and the second number (c) indicates the column of the pixel. The positive row axis oriented 90 degrees clockwise relative to the positive column axis. Each data Segment's location coordinates (r,c) identify the position of its origin (0,0) point relative to the location coordinates of the data Segment to which it is attached. The location coordinates are relative to the origin of the common coordinate system when the segment is attached to attachment level 0 (unattached).

5.5.13 NSIF File Segment Organization

A single NSIF file may comprise different types of segments. Data segments must be placed following the file header fields in the following order: Image Segment(s), Graphic Segment(s), Text Segment(s), Data Extension Segment(s), and Reserved Extension Segment(s). If an NSIF file contains more than one of the same segment types, each segment must include the applicable segment subheader preceding the content data. If a segment type is omitted, the subheader for that segment type will also be omitted.

5.5.14 File Size Constraints

The following are the maximum file size constraints for each CLEVEL:

5.5.14.1 For CLEVEL 03, unpack capable implementations must be able to unpack NSIF files with file sizes up to and including 50 Megabytes minus one byte. Implementations shall not pack files, marked as CLEVEL 3, of a size greater than 50 Megabytes minus one byte (50 Megabytes -1 = 52,428,799 bytes).

5.5.14.2 For CLEVEL 05, unpack capable implementations must be able to unpack NSIF files with file sizes up to and including one Gigabyte (Gbyte) minus one byte. Implementations shall not pack files, marked as CLEVEL 5, of a size greater than one Gbyte minus one byte (1Gbyte - 1 = 1,073,741,823 bytes)

5.5.14.3 For CLEVEL 06, unpack capable implementations must be able to unpack NSIF files with file sizes up to and including 2 Gbytes minus one byte. Implementations shall not pack files, marked as CLEVEL 6, of a size greater than 2 Gbytes minus one byte. (2Gbyte-1 = 2,147,483,647 bytes)

5.5.14.4 For CLEVEL 07, unpack capable implementations must be able to unpack NSIF files with file sizes up to and including 10 Gbytes minus one byte. Implementations shall not pack files, marked as CLEVEL 7, of a size greater than 10 Gbytes minus one byte (10Gbyte-1 = 10,737,418,239).

5.5.14.5 For CLEVEL 09, unpack capable implementations must be able to unpack NSIF files with file size greater that 10 Gbytes. Implementations capable of packing CLEVEL 09 NSIF files shall demonstrate their capability to pack a file with a size greater than 10 Gbytes.

5.5.15 Reduced and Enlarged Resolution Image Segments

Proper marking, identification and use of the image magnification/reduction factor value in the Image Magnification (IMAG) field of the Image Subheader are critical to a variety of image exploitation processes. This is particularly true, for example, when TREs containing support data referenced to the original source image row/column grid are preserved/copied into reduced (or enlarged) resolution image segments. To make proper use of the original (unmodified) support data, it is essential to maintain the correlation of the pixel value row/column indices in the magnified/reduced image array to their original row/column grid positions upon which the support data is based.

5.5.15.1 Unpack

5.5.15.1.1 Presentation of the pixel values in each image segment are aligned with the row/column reference grid of the CCS regardless of the individual image resolution as expressed in the image subheader IMAG field of each image segment. The first pixel of each image segment is located in the CCS at the row/column point indicated in the image subheader ILOC field relative to the attachment level reference point.

5.5.15.1.2 When using image support data (e.g., TREs) for image exploitation functions, the magnification (or reduction) factor, relative to the original source image resolution upon which the support data is based, must be included in the exploitation process.

5.5.15.1.3 When the image subheader IMAG field is populated with the designated default value "1.0 " (or "1.00") the image support data is interpreted as being directly correlated with the pixel array data in the image segment.

5.5.15.1.4 When fractions or decimal values of less than 1.0 (or 1.00) appear in the image subheader IMAG field to indicate the magnification (or reduction) factor, the potential impact of the available precision in the field must be considered in the "error budget" of exploitation processes using the value.

5.5.15.1.5 When an ICHIPx TRE is available for the image segment, the reduction/magnification value in the SCALE_FACTOR field takes precedence over the corresponding value in the image subheader IMAG field. (NOTE: It is recommended that the implementation provide a means to alert the user if the values in the SCALE_FACTOR and IMAG field are inconsistent when interpreting the file.

5.5.15.1.6 When decoding a JPEG 2000 compressed image data segment, the parameters in the Image and Tile Size (SIZ) Marker Segment fields and codestream take precedence over the corresponding value in the image subheader IMAG field. (NOTE: It is recommended that the implementation provide a means to alert the user if the values in the SIZ Marker Segment with codestream and IMAG field are inconsistent when interpreting the file.)

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5.5.15.2 Pack

5.5.15.2.1 An NSIF file may be packed with multiple image segments, some of which have different resolutions (different image subheader IMAG field values). When doing so, the image segments are placed in the NSIF Common Coordinate System (CCS) using the image subheader ILOC field values to identify the row/column position (relative to the attachment level reference point) of the first pixel of each image array in the CCS regardless of individual image segment resolution.

5.5.15.2.2 The value in the image subheader IMAG field of each image segment represents the resolution magnification (or reduction) factor of the segment's pixel array data as compared with the original source resolution of the image data upon which the image segment's support data is based.

5.5.15.2.3 When the resolution of the image pixel array data and associated support data directly correlate, the image subheader IMAG field is populated with the designated default value, 1.0 (followed by a space character), or alternatively, "1.00".

5.5.15.2.4 For reductions that are reciprocals of non-negative powers of two (2), the image subheader IMAG field is populated using the /2 (for ½), /4 (for ¼), etc. convention, or with decimal values are used to indicate the magnification (or reduction) factor.

5.5.15.2.5 When creating files with an ICHIPB TRE the resolution association between the TRE SCALE_FACTOR field and the corresponding value in the image subheader IMAG field must be consistent and correctly based on the resolution of the original source image.

5.5.15.2.6 When creating a JPEG 2000 compressed image data segment, the parameters in the Image and Tile Size (SIZ) Marker Segment fields within the codestream and the corresponding value in the image subheader IMAG field must be consistent and correctly based on the resolution of the original source image.

5.5.15.2.7 Alteration of pixels, such as anamorphic correction, is discouraged during generation of reduced or enlarged resolution segments. However, if warranted by programmatic or specification requirements, ICHIPx TRE will be employed to properly denote the alteration. HISTOx TRE will be used in the event the ICHIPx cannot properly document the change.

5.6 Image Segment Criteria

For all implementations: This section is used in conjunction with Table D-1 of ISO/IEC BIIF Profile NSIF 01.01 to establish criteria, based on CLEVEL, for each of the following:

5.6.1 Unpack

The implementation must be able to unpack NSIF files containing single block Image Segment(s) and NSIF files containing multiple-blocked Image Segment(s) comprised of the applicable pixel size ranges for each respective CLEVEL. For multi-blocked Image Segments, the implementation must support single blocked images from 1 by 1 pixel up to the maximum size designated for the CLEVEL, and multiple-blocked images beginning at 1x1 pixel blocks up to the maximum image size designated for the CLEVEL.

In the cases were a LUT is allowed, all image data that applies to a given pixel shall be fully decompressed before a LUT is applied to that pixel so that it is applied to data without any loss.

The blocked pixel ranges for each CLEVEL are:

- 0001 to 2048 pixels by 0001 to 2048 pixels for CLEVEL 3
- 0001 to 8192 pixels by 0001 to 8192 pixels for CLEVELs 5, 6, and 7
- a single block size greater that 8192 pixels in the horizontal, vertical or both directions shall be marked as CLEVEL 09.

Image Segments are formatted as follows (see also NSIF01.01 Table D-1):

5.6.1.1 Single band, Image representation (IREP) Mono or EO, Image Mode (IMODE) B (Band Interleaved by Block), as follows:

- Uncompressed, 1, 8, 12, 16, 32, or 64 bits-per-pixel per band, with and without LUT, single and multiple blocks, with and without masking tables
- JPEG DCT compressed, 8 or 16 bits, without LUT, single and multiple blocks, Block Mask Record only
- JPEG 2000 compressed IMODE B, 1 to 32 bits, single and multiple blocks with options:
  - Lossy without LUTs, Block Mask Record only
  - Numerically lossless with or without LUT, with and without masking tables
- Downsampled JPEG DCT, 8 bit, without LUT, and without masking tables, single block only
- Bi-Level, 1 bit, without or with LUT, and without masking tables, single block only
- VQ, 8 bit, single and multiple blocks.

5.6.1.2 Single band color IREP RGB/LUT, with three LUTs (R, G and B), with and without masking tables, IMODE B, as follows:

- Uncompressed, 8 bit, single and multiple blocks
- Bi-Level, 1 bit, single block only
- JPEG 2000 only with numerically lossless option, 8-bit, single and multiple blocks. All codestream data that applies to a given pixel (i.e., Layer, Resolution, Quality Component or Precinct) shall be fully decompressed before the LUT is applied to the pixel so that it is applied to data without any loss.
- VQ, 8 bit, single and multiple blocks.

5.6.1.3 Color, three-bands (RGB), IREP RGB, single and multiple blocks, with and without mask tables as follows:

- Uncompressed, without LUTs, image having the following Image Mode (IMODE):
  - B (Band Interleaved by Block)
  - P (Band Interleaved by Pixel)
  - S (Band Sequential) (Only valid for multiple block and multiple band)
  - R (Band Interleaved by Row)
- JPEG DCT compressed IMODE P, without LUTs, Block Mask Record only.
- JPEG 2000 lossy compressed IMODE B, without LUTs, Block Mask Record only.
- JPEG 2000 numerically lossless compressed IMODE B, with or without LUTs.

5.6.1.4 Color (24-bit), three-bands IREP YCbCr, 8 bits-per-pixel in each band, single and multiple blocks, without LUTs, with and without masking tables, JPEG DCT compressed image data ordered as Band Interleaved by Pixel, IMODE P.

5.6.1.5 Multiband, up to 999 bands (depending upon applicable CLEVEL), single and multiple blocks with and without mask tables, image data ordered as follows:

- Uncompressed, 8, 12, 16, 32, or 64 bits-per-pixel for each band, with and without LUTs having the following IMODE:
  - B
  - P

    - S (Only valid for multiple block and multiple band)
    - R
- JPEG DCT compressed, 8 or 16 bits, without LUTs, Block Mask Record only, having the following IMODE:
    - B
    - S (Only valid for multiple block and multiple band)
- JPEG 2000 compressed IMODE B, 1 to 32 bits with options:
    - Lossy without LUTs, Block Mask Record only
    - Numerically lossless with or without LUTs

5.6.1.5.1 For the single band case, the implementation must be able to display the multiband image as a monochrome image. In other words, the implementation must be able to display one of the bands of the multiband image, separately as a monochrome image.

5.6.1.5.2 For the two-band case, the implementation must be able to at least present either band of a two-band image segment according to the value of the IREPBAND field. First priority must be given the band marked LU and the LUT must be applied for the presentation. If LU is not present, the implementation must present the band marked M if present. If neither LU nor M is present, the implementation may allow an operator the capability to select specific band for display.

5.6.1.5.3 For the three-band or greater case, the implementation must be able, as the default presentation, to present any three-bands of the same pixel depth and any single band of a multiband image as indicated by the values appearing in the IREPBANDn fields. First priority must be given to those bands marked R, G, and B. If no bands are marked R, G, and B, the next priority goes to the first band marked LU. Lacking any bands marked LU, the implementation must present the first band marked M. If no bands are marked for display, the implementation will display the first three bands in the order R, G and B.

5.6.1.5.4 Once imagery of two or greater bands is initially presented, the implementation may offer additional presentation options to the operator. For example, the operator may be allowed to select any of the bands, or combinations of the bands for display, print, or further processing.

5.6.1.5.5 When IREPBAND is filled with BCS Spaces (code 0x20), no specific representation is defined for the band, but it may be displayed if desired.

5.6.1.5.6 Unpack capable implementations may optionally support decompressing of multi-component compressed multiband image segments.

5.6.1.6. Elevation Data

Support of uncompressed image segments containing elevation data is optional. When supported, the implementation must be able to unpack and interpret the data in the single-band elevation data image segment as follows:

5.6.1.6.1 The implementation will recognize that the image segment(s) contains elevation data when the ICAT field contains the value DTEM (Digital Terrain Elevation Matrix).

5.6.1.6.2 The ISUBCAT field value will be interpreted as the unit of elevation measure according to the codes identified in DIGEST Part 3-7, Units of Measure Codes.

5.6.1.6.3 The implementation must interpret the ratio of image pixels to grid elements so that the appropriate grid element is identified with the appropriate pixel of the associated image segment.

5.6.1.6.4 The implementation must return an elevation value representative of each posting. If interpolation is used, the implementation must employ the interpolation algorithm defined in DIGEST Part 2, Annex D.1.2.4.

5.6.1.6.5 Calculation of elevation must not presume greater vertical and horizontal accuracy than the support data provides for. (It is recommended that the accuracy be reported to the user)

5.6.1.6.5 In the instance that two-elevation grid segments overlap, the segment with the highest display level will have precedence when displaying elevation.

5.6.1.7 Location Grid Data. Support of uncompressed image segments containing location grid data is optional. When supported, the implementation must be able to unpack and interpret the data in the two-band location grid data image segment as follows:

5.6.1.7.1 The implementation will recognize that the image segment(s) contains location data when the ICAT field contains the value LOCG.

5.6.1.7.2 The ISUBCAT field value will be interpreted as either CGY and CGX for cartographic or GGY and GGX for geographic location values.

5.6.1.7.3 The implementation must interpret up to twenty location grid segments that are associated with a single image segment.

5.6.1.7.4 The implementation must interpret the ratio of image pixels to grid elements so that the appropriate grid element is identified with the appropriate pixel of the associated image segment.

5.6.1.7.5 Calculation of location must not presume greater accuracy than the data within the support data of the image segment. (It is recommended that the accuracy be reported to the user)

5.6.1.7.6 For each location grid, the implementation must interpret both geographic and Cartesian location values.

5.6.1.7.7 When location points are less frequent than pixel values of an image segment, the system must interpolate between grid points as defined in DIGEST, Part 2 Section 10.1.2

5.6.1.7.8 In the instance that two elevation grid segments overlap, the segment with the highest display level will have precedence when displaying elevation.

5.6.1.8 Matrix Data

The support of uncompressed, JPEG DCT or JPEG 2000 Matrix data is optional. Since there is no means to identify the meaning or significance of the matrix data, pack applications of such data must externally inform unpack applications of the data as to the meaning of the data. Once community utility of specific types of matrix data has been established and documented, either an explicit ICAT code for the data will be established or a TRE will be used to identify the data. Upon receipt of files with image segments of ICAT = MATR, unpack applications must at least be able to skip past this segment and unpack other segments within the file. The operator must be alerted that the file contained this type of image segment.

5.6.1.9 Pixel Value Type

An implementation must be able to unpack files with the following pixel value types:

5.6.1.9.1 Pixel value type B (Boolean); NBPP = 1; ABPP = 1.

5.6.1.9.2 Pixel value type INT (unsigned Integer); NBPP = 8, 12, 16, 32, and 64; ABPP = 1 to 64.

5.6.1.9.3 Pixel value type SI (Signed Integer); NBPP = 8, 12, 16, 32, and 64; ABPP = 8 to 16, 32, and 64.

5.6.1.9.4 Pixel value type R (Real); 32 bit and 64 bit floating-point representation; NBPP = 32 and 64; ABPP = 32 and 64.

5.6.1.9.5 Pixel value type C (Complex); the values represented with real and imaginary parts; each in 32-bit floating point representation and appearing in adjacent blocks, first real, then imaginary. NBPP = 64; ABPP = 64.

5.6.1.10 ICORDS/IGEOLO

Implementations that support geographic location information contained in the image segment subheader must be able to interpret one or more of the coordinate representation types specified in the Image Coordinate Representation (ICORDS) field. The following are valid values found in the ICORDS field:

- D indicates Geographic coordinates of Latitude and Longitude expressed in decimal degrees.
- G indicates Geographic coordinates, Latitude and Longitude expressed in degrees, minutes and seconds.
- U indicates Universal Transverse Mercator (UTM) expressed in Military Grid Reference System (MGRS) form.
- N indicates UTM coordinates, Northern Hemisphere.
- S indicates UTM coordinates, Southern Hemisphere.

- P indicates UPS coordinates in either the Northern or Southern Hemisphere.
  (Dependent on upcoming changes to NSIF Profile of BIIF)

5.6.1.10.1 Implementations that support geographic location cataloging must be able to interpret the four corner location data points in the following order, from the upper left corner of the image clockwise ending at the bottom left corner of the image.

5.6.1.10.2 Since no projection or accuracy is associated with the IGEOLO corner coordinates in the image subheader (the geodetic reference system is defined to be WGS84), the implementation must not use the data for other than determining approximate location. Systems must not use these coordinates for precise positioning or measurements.

5.6.1.10.3 Implementations must resolve instances where any of the four-corner coordinates are not in the same hemisphere (Northern or Southern) or cross the International Data Line (Eastern or Western hemisphere).

5.6.1.11 ICAT/ISUBCAT

Generally, code values in the image subheader Image Category (ICAT) and image subcategory (ISUBCAT) fields have no defined significance when unpacking an image segment. They are simply informational (often used for cataloging purposes). In some cases, however, the code values in the ICAT and ISUBCAT fields have impact on the interpretation of data values during the unpack processes.

5.6.1.11.1 The following ICAT and associated ISUBCAT code values are generally provided for informational or cataloging purposes only. No specific handling or presentation requirements are specified when unpacking.

- ICAT = VIS, SL, TI, FL, RD, EO, OP, HR, CP, BP, SAR, FP, VD, MAP, PAT, or LEG where ISUBCAT = Spaces.
- ICAT = IR, MS or HS where ISUBCAT may equal the wavelength of the associated data in the band.
- ICAT = MATR where ISUBCAT contains FACC codes from DIGEST Part 4 Annex B.

5.6.1.11.2 The following ICAT and associated ISUBCAT code values require special handling during the unpack process.

- ICAT = LOCG where ISUBCATn = CGX, CGY, GGX, GGY.
- ICAT = BARO, DEPTH, or DTEM where ISUBCAT = unit of measure code from DIGEST Part 3-7.
- ICAT = SARIQ where ISUBCATn = I, Q or M, P or BCS spaces.
- ICAT = WIND or CURRENT where ISUBCATn = SPEED and DIRECTION.

5.6.2 Pack

The implementation must be able to pack NSIF files that do not exceed the maximum pixel size and blocking constraints identified in the Unpack paragraph 5.6.1. The implementation must ensure that the operator cannot create files that exceed the maximum unpack boundary conditions for the respective CLEVEL. Optional pack implementations will follow the same test criteria as specified for unpack.

5.6.2.1 The implementation may optionally pack monochrome (1, 8, 12, 16, 32, or 64 bpp) single band (IREP) MONO imagery.

5.6.2.2 The implementation may optionally pack Single band RGB color (RGB/LUT) imagery.

5.6.2.3 The implementation may optionally pack three-bands color (RGB) imagery, Image Representation (IREP) RGB.

5.6.2.4 The implementation may optionally pack 1 bit-per-pixel Image Segments, with and without a LUT.

5.6.2.5 The implementation may optionally pack JPEG DCT compressed image segments.

5.6.2.6 The implementation may optionally pack JPEG 2000 compressed image segments.

5.6.2.7 The implementation may optionally pack VQ compressed image segments. VQ re-compression of decompressed VQ image segments is prohibited; however, a decompressed VQ image segment may be packed in its uncompressed state (NC or NM) or in its original compressed form (C4 or M4). Extracted portion(s) of a VQ compressed image may be repacked using the original codebook and codes from the original coded pixel data.

5.6.2.8 The implementation may optionally pack multiband uncompressed, JPEG DCT or JPEG 2000 image segments. A multiband image segment must have at least one band and no more than 99,999 bands. The IREPBANDn fields must be populated within the criteria established for unpacking multiband images.

5.6.2.9 The implementation may optionally pack downsampled JPEG compressed image segments.

5.6.2.10 Elevation grid data
The implementation may optionally pack uncompressed image segments containing elevation data.

5.6.2.10.1 The generation of image segments containing elevation data is optional. When supported, the implementation must be able to pack elevation data in the single-band elevation data image segment as follows:

- The implementation will enter the value DTEM to the ICAT field of the image subheader.
- The implementation will enter the unit of elevation value (codes identified in DIGEST Part 3-7, Table 7-1 Units of Measure Codes) to the ISUBCAT field of the image subheader.
- The implementation must not exceed 20 elevation grid segments per single image segment.

5.6.2.11 Location grid data
The implementation may optionally pack uncompressed image segments containing location grid data.

5.6.2.11.1 The generation of image segments containing location grid data is optional. When supported, the implementation must be able to pack location grid data image segment as follows:

- The implementation will enter the value LOCG to the ICAT field of the image subheader.
- The implementation will apply either CGY and CGX for cartographic or GGY and GGX for geographic location values in the ISUBCAT field of the image subheader.
- The implementation must not exceed 20 elevation grid segments per single image segment.

5.6.2.12 Matrix data
The implementation may optionally pack uncompressed, JPEG DCT or JPEG 2000 image segments containing matrix data. Since there are no means to identify the meaning or significance of the matrix data, pack applications of such data must externally inform unpack applications of the data as to the meaning of the data. Once community utility of specific types of matrix data has been established and documented, an explicit ICAT code for the data will be established.

5.6.2.12.1 Pack applications of image segments with ICAT = MATR data must do so in accordance with all criteria established for packing of imagery segments.

5.6.2.13 Pixel Value Type
An implementation may pack files with any of the following pixel value type:

5.6.2.13.1 Pixel value type B (Boolean); NBPP = 1; ABPP = 1.

5.6.2.13.2 Pixel value type INT (unsigned Integer); NBPP = 2 to 8, 12, 16, 32, and 64; ABPP = 2 to 16, 32, and 64.

5.6.2.13.3 Pixel value type SI (Signed Integer); NBPP = 2 to 8, 12, 16, 32, and 64; ABPP = 2 to 16, 32, and 64.

5.6.2.13.4 Pixel value type R (Real); 32-bit and 64-bit floating point representation; NBPP = 32 and 64; ABPP = 32 and 64.

5.6.2.13.5 Pixel value type C (Complex). The values represented with real and imaginary parts; each in 32-bit floating point representation and appearing in adjacent blocks, first real, then imaginary. NBPP = 64; ABPP = 64.

5.6.2.14 ICORDS/IGEOLO

5.6.2.14.1 Implementations that support geographic location information may populate the IGEOLO field with the approximate geographic location corner points using any of the coordinate representations specified for the Image Coordinate Representation (ICORDS) field. For images containing horizons, the IGEOLO field contains the coordinates for the corners of the meaningful ground coverage. The following are valid values for the ICORDS field:

- The value "D" indicates geographic coordinates of Latitude and Longitude expressed in decimal degrees.
- The value "G" indicates Geographic coordinates, Latitude and Longitude expressed in degrees, minutes, and seconds.
- The value "U" indicates UTM expressed in Military Grid Reference System (MGRS) form.
- The value "N" indicates UTM coordinates, Northern Hemisphere.
- The value "S" indicates UTM coordinates, Southern Hemisphere.

- P indicates UPS coordinates in either the Northern or Southern Hemisphere.
  (Dependent on upcoming changes to NSIF Profile of BIIF)

5.6.2.14.2 When populating the IGEOLO field, implementations must apply the four-corner location points in the following order: from the upper left corner of the image (Row 0, Column 0) clockwise ending at the bottom left corner of the image (Max Row, Column 0).

5.6.2.14.3 Implementations must not populate the IGEOLO fields with more precision than warranted, given the source of the information.

5.6.2.15 ICAT/ISUBCAT

5.6.2.15.1 An implementation may pack files using any of the following ICAT/ISUBCAT codes:

- ICAT = VIS, SL, TI, FL, RD, EO, OP, HR, CP, BP, SAR, FP, VD, MAP, PAT, LEG; where ISUBCAT = Spaces.
- ICAT = IR, MS or HS where ISUBCAT = the wavelength of the associated data in the band.
- ICAT = LOCG, where ISUBCATn = CGX, CGY, GGX, GGY.
- ICAT = SARIQ where ISUBCATn = I and Q or M and P.

- ICAT = BARO, DEPTH, or DTEM where ISUBCAT = unit of measure code from DIGEST.
- ICAT = WIND or CURRENT, where ISUBCAT = SPEED and DIRECTION.
  ICAT = MATR

5.6.2.16 When a file is created from a preexisting uncompressed Image Segment that is going to be transmitted as it is being compressed (near real time compression) and all information in the file is known with the exception of the total file size and first Image Segment size (based on contents of the initial file, the lengths of all other data elements are known), only a completed file header will be contained in the STREAMING_FILE_HEADER§ DES and the file itself may contain other data elements. If the file results from a near real time collection process, it must contain only a single image and the STREAMING_FILE_HEADER§ DES will contain a completed file header, first image subheader, and associated tag data included in the extension area if required. In either case, the STEAMING_FILE_HEADER§ DES must be the last segment in the file.
(§ - The STREAMING_FILE_HEADER DES is now deprecated and should no longer be used. There are no know production systems that used this DES.)

5.7 Multiple Image Segment Criteria

5.7.1 For CLEVEL 3, the IUT interprets NSIF files with up to 20 Image Segments.

5.7.2 For CLEVEL 5, 6, and 7, the IUT interprets NSIF files with up to 100 Image Segments.

5.7.3 For CLEVEL 3, the IUT does not generate NSIF files that have more than 20 Image Segments.

5.7.4 For CLEVEL 5, 6, and 7, the IUT does not generate NSIF files that have more than 100 Image Segments. These implementations must be able to create compliant NSIF files that are downward compatible (no more than 20 total image segments per file) with lower CLEVELs.

5.7.5 For CLEVEL 9, an implementation must be able to interpret/generate compliant NSIF files that have more than 100 but less than 1000 Image Segments per file.

5.7.6 Image segments are properly positioned within the common coordinate system according to the coordinates identified in the image subheaders.

5.7.7 All image segments in a file must conform to the compliance criteria established for image segments in paragraph 5.6.

5.8 Image Compression Criteria, Joint Photographic Experts Group (JPEG)

All unpack capable implementations must support JPEG decompression using JPEG DCT and JPEG 2000. JPEG DCT must support Huffman Entropy decoding, with both 8-bit and 12-bit precision modes of operation. Implementations must support the use of restart markers in the compressed data. Similarly, all pack capable implementations with the requirement to support JPEG compression must implement JPEG DCT compression in accordance with the specifications and guidance contained in ISO/IEC IS 10918-1, Digital compression and coding of continuous-tone still images. JPEG 2000 must support ISO/IEC 15444-1, Information technology - JPEG 2000 image coding system, and within the bounds of the criteria established for unpacking (See annex D for JPEG 2000).

5.8.1 JPEG, Sequential DCT Lossy

5.8.1.1 The IUT must support the Sequential DCT based modes of compression using Huffman Entropy encoding. The image compression field of the image subheader is set to C3 and/or M3 when the image has been compressed using JPEG DCT. The Compression Rate (COMRAT) Code Field of the Image Subheader is set to the value identifying the embedded quantization and Huffman table(s) used by the JPEG compression algorithm. (See ISO/IEC BIIF Profile NSIF 01.01, Table C-1-3, field COMRAT)

5.8.1.2 The IUT supports 8-bit and 12-bit source sample precision for all CLEVELs. When the source sample precision is 2 through 7-bits, the data must be converted to eight bits. If the source sample precision is 9 through 11, or more than 12 bits, the data must be converted to 12 bits-per-pixel for compression. A recommended but not mandatory conversion process is described in paragraph 6.2 of MIL-STD-188-198A.

5.8.1.3 The encoder must generate the full interchange format. The full interchange JPEG format is a data stream containing all the tables, markers and Segments necessary to decode and render the compressed image. The use of default or prepositioned tables to decompress an image is prohibited.

5.8.1.4 For monochrome imagery and color (RGB) imagery compressed as RGB, the quantized DCT coefficient accuracy from the DCT based encoder is within +/- 1 for each coefficient, when compared to reference test data created from a double precision reference encoder.

5.8.1.5 Once the criteria in paragraph 5.8.1.4 has been met, RGB color test images transformed into YCbCr color space and JPEG encoded by the IUT must have the same general appearance when decoded and displayed as the test images which were encoded, decoded, and displayed in RGB color space by the IUT.

5.8.1.6 The decoder must interpret the full interchange format.

5.8.1.7 The decoder interprets the abbreviated interchange format when the NSIF application is required to decode legacy NITF 2.0 only.

5.8.1.8 For either monochrome and color (RGB) imagery compressed as RGB, the output of the DCT based decoder, when passed through a reference Forward DCT (FDCT) and Quantizer, is accurate to within +/- 1 for each coefficient, when compared to reference test data created from a double precision reference decoder.

5.8.1.9 Once the criterion in paragraph 5.8.1.8 has been met, JPEG encoded YCbCr test images decoded and displayed by the IUT must have the same general appearance as the RGB equivalent compressed images when decompressed and displayed in RGB color space by the IUT.

5.8.1.10 The encoder must include the Quantization Tables (Q-Tables), as well as Huffman Tables (H-Tables), used in the compressed data stream.

5.8.1.11 The decoder makes use of Q-Tables when included in the JPEG header.

5.8.1.12 The decoder makes use of the Binary Digits (BITS) and Huffman Values (HUFFVALS) tables included in the JPEG header.

5.8.1.13 If the IUT is capable of generating custom BITS and HUFFVALS tables, they are generated in accordance with JPEG ISO.IEC IS 10918-1.

5.8.1.14 If the Define Q-Table (DQT) marker is present in the compressed data, the table specified by the DQT marker takes precedence over any table specified by the COMRAT field in the NSIF image subheader.
Note: The above restriction also applies to packing of NITF 2.0 files.

5.8.1.15 If an IUT can generate a custom Q-Table, that Q-Table must be in accordance with ISO.IEC IS 10918-1.

5.8.1.16 The encoder includes restart marker code(s) in the entropy encoded data stream. The encoder must be able to place at least one restart marker code per eight-pixel rows (one row of Neighborhoods). The encoder must place no more restart marker code(s) than one per neighborhood.

5.8.1.17 The entropy decoder must re-synchronize the decompression at the next restart marker when data is corrupted in the entropy-encoded stream.

5.8.1.18 JPEG entropy decoders shall be able to decode and display a JPEG compressed image in which no more than 10% of the restart intervals in the compressed data stream contain errors. JPEG entropy decoders will recognize the following as errors:

5.8.1.18.1 Restart Marker appearing too early in the data stream

5.8.1.18.2 Restart Marker appearing too late in the data stream

5.8.1.18.3 Restart Marker missing from the data stream

5.8.1.18.4 Unknown Huffman code in the data stream

5.8.1.19 When the entropy decoder detects any of these errors in the compressed JPEG data stream, the imagery implementation must identify the corrupted data in the decoded image. Reporting or replacing the corrupted restart interval with a suitable pattern is required so that when the decoded image is displayed, it will be apparent that the compressed data stream had an error. This pattern shall be limited to the Re-Start (RST) Marker Interval(s) in which the error occurred. All RST intervals without errors must be decoded and displayed.

5.8.2 JPEG, Sequential DCT Lossy with Post Processing Extensions

5.8.2.1 An unpack implementation may optionally support post-processing of JPEG decompressed pixel data when the IOMAPA tagged record extension is indicated with the image segment.

5.8.2.2 A pack implementation may optionally pre-process image pixel data prior to JPEG compression. When doing so, only the processes allowed in the IOMAPA tagged record extension are allowed. The IOMAPA extension must be associated with the image segment and its fields must be populated with the constraints established for the packing of the IOMAPA extension.

5.8.3 JPEG, Downsampled JPEG

5.8.3.1 Compression. To verify that the IUT properly implements the downsampled phase of the Downsample JPEG algorithm, the IUT must implement the JPEG DCT 8 bit-per-pixel compression in a manner to accept externally provided Huffman and Quantization tables. The test facility will provide these tables during compliance testing. Alternately, the IUT must make available a file containing the actual downsampled pixel values before JPEG compression.

5.8.3.1.1 The IUT encoder must limit the use of Downsampled JPEG to monochrome image segments that are single blocked and are no larger than 2048 by 2048 pixels.

5.8.3.1.2 The IUT supports the sync-based mode for downsampling.

5.8.3.1.3 The Image Compression (IC) field of the image subheader is set to I1 when the image has been compressed using the Downsampled JPEG compression algorithm.

5.8.3.1.4 Downsampling supports anti-aliasing sampling.

5.8.3.1.5 Downsampling only uses sampling ratios that are greater than one.

5.8.3.1.6 Downsampling is performed twice, once for each respective dimension rows and columns.

5.8.3.1.7 Downsampling clamps to an integer multiple of 8 pixels for both the horizontal and vertical dimensions.

5.8.3.1.8 Downsampling mirrors the edge of the original image before downsampling.

5.8.3.2 De-Compression
To verify that the IUT properly implements the upsample phase of the downsample JPEG algorithm, the IUT must implement the JPEG DCT 8 bit-per-pixel decompression in the following manner. The IUT must be able to save to an NSIF file the output of the JPEG DCT decompressor module, and the output of the upsample algorithm before further processing to either takes place. i.e. remapping by the video driver for display.

5.8.3.2.1 The IUT supports the sync-based mode for upsampling.

5.8.3.2.2 The bit depth (bits-per-pixel) remains the same throughout the process (downsampling->JPEG Compression->JPEG Decompression->upsampling).

5.8.3.2.3 When error(s) in the decompression process occurs in the data stream, the IUT must replace the encoded/decoded image file corrupted data with a pattern so that when the image is displayed it is apparent that the compressed image data had an error. This pattern will be limited to the upsampled pixels corresponding to the JPEG RST interval(s) in which the error occurred. All RST intervals without errors must be decoded and displayed.

5.8.3.2.4 Upsampling only uses sampling ratios that are less than one.

5.8.3.2.5 Upsampling is performed twice, once for each respective dimension rows and column.

5.8.3.2.6 Frequency of the original signal matches the frequency of the upsampled signal.

5.8.3.3 File Compliance

5.8.3.3.1 Files with Downsampled JPEG compressed image segments and overlay segments must adhere to location, display level and attachment level criteria.

5.8.3.3.2 Pixel locations will be the same before downsampling and after upsampling. (Visually it may appear that there has been some movement due to the JPEG compression/de-compression algorithm's use of neighborhoods).

5.8.3.3.3 IUT supports 8-bit monochrome images without LUT.

5.8.3.3.4 IUT supports downsampling/upsampling of both even and uneven image sizes.

5.8.3.3.5 IUT supports single blocked image segments.

5.8.3.3.6 The COMRAT field of the image subheader is set to 00.x when general purpose tables are employed and to 04.x when downsample tables are used. Other tables that may be used can be found in the latest ISO/IEC BIIF Profile for NSIF, Table C-1-3.

5.8.4 JPEG, DCT Lossless

5.8.4.1 The IUT supports lossless sequential mode of compression and decompression using Huffman Entropy encoding and decoding for 8, 12, 16 and 24 bpp source imagery. The compression field of the Image Subheader must be set to C5 or M5 when compressing the image using Lossless (sequential) JPEG. The COMRAT field of the Image Subheader must be set to the value identifying the embedded quantization table(s) used by the JPEG compression algorithm. (See the latest ISO/IEC BIIF Profile for NSIF, Table C-1-3).

5.8.4.2 The encoder must generate the full interchange JPEG format. The full interchange JPEG format is a data stream containing all the tables, markers and segments necessary to decode and render the compressed image. The use of prepositioned tables to decompress an image (abbreviated interchange JPEG format) is prohibited.

5.8.4.3 The decoder interprets the full interchange format

5.8.4.4. The encoder must include the Huffman Tables (H-Tables) used to compress the image, in the JPEG data stream.

5.8.4.5 The decoder must make use of the H-Tables found in the JPEG stream to decompress the entropy data. This includes split and short H-Tables.

5.8.4.6 Compression Accuracy
IUTs must accurately compress image data into an image segment so that the segment, when decompressed by a trusted lossless JPEG implementation, yields an image array identical to the original uncompressed image data.

5.8.4.7 Decompression Accuracy
IUTs must accurately decompress a lossless encoded JPEG image segment that was produced by a trusted encoder so that the resulting decompressed image array is identical to the original uncompressed image data.

5.8.4.8 If the IUT is capable of generating custom Huffman Tables, they must be generated in accordance with Appendix C of the JPEG MIL-STD-188-198A.

5.8.4.9 The encoder must be able to include restart marker codes in the entropy encoded data stream, at least one marker for every eight rows of image data per frame.

5.8.4.10 The entropy decoder must re-synchronize the decompression at the next restart marker when encountering corrupted data in the entropy encoded stream.

5.8.4.11 JPEG entropy decoders must be able to decode and display a JPEG compressed image in which no more than 10% of the restart intervals in the compressed data stream contain errors. When the entropy decoder detects errors in the compressed JPEG data steam, the imagery implementation must identify the corrupted data in the decoded image. The implementation must replace the corrupted restart interval with a suitable pattern so that when displaying the decoded image, the compressed data stream error is apparent. (a 2x2, two-color checkerboard pattern per JPEG neighborhood is recommended for this replacement pattern.) This pattern must be limited to the RST interval(s) in which the error(s) occurred. All RST intervals without errors must also be decoded. JPEG entropy decoders must be able to recognize the following as errors:

5.8.4.11.1 Restart Marker appearing too early in the data stream

5.8.4.11.2 Restart Marker appearing too late in the data stream

5.8.4.11.3 Restart Marker missing from the data stream

5.8.4.11.4 Unknown Huffman code in the data steam

5.8.5 JPEG 2000

Specific criteria for JPEG 2000 are contained in within Annex D of this document.

5.9 Image Compression Criteria, Bi-Level

5.9.1 The IUT supports Bi-level image compression with IC field value set to C1 or M1 with modes of operation as follows:

5.9.1.1 1D for One Dimensional Coding (Encode is optional; decode is mandatory).

5.9.1.2 2DS for Two Dimensional Coding, Standard Vertical Resolution, K=2 (Encode is optional; decode is mandatory).

5.9.1.3 2DH for Two Dimensional Coding, High Vertical Resolution, K=4 (Encode is optional; decode is mandatory).

5.9.2 The IUT encoder supports compression of Bi-level images with horizontal scan lines containing up to and including 2560 pixels and containing up to and including 8192 scan lines as constrained by CLEVEL limits.

5.9.3 The IUT decoder supports decompression of Bi-level images with horizontal scan lines containing up to and including 2560 pixels and containing up to and including 8192 scan lines as constrained by CLEVEL limits.

5.9.4 Images compressed by the IUT encoder must compare bit-by-bit with the same images compressed by the test facility's trusted reference encoder after decompression.

5.9.5 Images decompressed by the IUT decoder must compare bit-by-bit with the same images decompressed by the test facility's trusted reference decoder.

5.9.6 The IUT must support the use of synchronization and Huffman codes.

5.9.7 Bi-Level compressed images are always a single block; multiple blocks are not allowed with Bi-level compression.

5.9.8 Unpack capable implementations must be able to identify and properly present pad pixels when the pad output pixel code value is identified in mask table records.

5.10 Image Compression Criteria, Vector Quantization (VQ)

5.10.1 When the image compression field is set to M4 or C4, the image data of the VQ compressed image segment shall contain a VQ header followed by the compressed image data as specified in MIL-STD-188-199.

NOTE: For M4 the image data of the VQ compressed image segment will be preceded by an image data mask table followed by the VQ header.

5.10.2 The IUT will support both v x h kernel-by-kernel decompression and individual rows for all v x h kernels stored together such that the image can be decompressed line-by-line.

5.10.3 The first image code in the VQ compressed image segment will be used to spatially decompress the v x h indices in the upper left corner of the image. The decompression will continue from left to right across the columns of the first row of image codes, then down each of the rows of image codes sequentially.

5.10.4 For RGB color or monochrome with LUT images that are compressed, each value in the spatially decompressed image represents an index into the output.

5.10.5 VQ implementations within NSIF will be tested to a limit of 8-bit RGB with LUT, or monochrome with or without LUT.

5.10.6 The COMRAT field must be present in all NSIF VQ files and must contain a value given in the form n.nn representing the average number of bits-per-pixel for the image after compression. This entry is for informational purposes only and is not necessary for the decompression process.

5.10.7 The IC field will contain the value C4 if the image is not masked or M4 if the image is masked.

5.10.8 For the testing, the NSIF VQ image data section shall provide up to 4096 compression codes entries, organized in a 4x4 kernel configuration.

5.10.9 The implementation of VQ within NSIF uses a single band with an associated LUT, and has an IMODE of B, band interleaved by block.

5.10.9.1 For VQ NSIF applications, the number of spectral groups is 1.

5.10.9.2 The number of blocks per row and number of blocks per column fields within the NSIF image subheader define the number of image block tables in the spatial data subsection.

5.10.9.3 If the image is Red, Green, Blue (RGB/LUT), the pixels are indices into a color LUT. If the image is monochrome, the pixels can be indices into a grayscale LUT.

5.10.9.4 The image row level of organization in the NSIF image subheader shall correspond to the image row level in the VQ header.

5.10.9.5 The number of bands in the NSIF image subheader will correspond to the number of bands in the VQ header, which will be one.

5.10.10 Fields containing identification and origination information, file security information, and the number and size of the data items contained in the NSIF file shall be located in the NSIF file header. Within the image data section, multi-byte fields are written in the "big endian" format.

5.10.11 The VQ header must have the structure identified in ISO/IEC IS 12087-5, Annex B.

5.10.12 The implementation may optionally compress images using VQ, but may only do so within the bounds and constraints established for VQ decompression. VQ recompression of decompressed VQ images is prohibited; however, a decompressed VQ image may be packed in its uncompressed state (NC or NM) or in its original compressed form (C4 or M4). An extracted portion(s) of a VQ compressed image may be repacked using the original codebook and codes from the original coded pixel data.

5.11 Graphic Segment Criteria, CGM Graphics

5.11.1 An implementation must be able to interpret and use an NSIF file containing 0 to 100 CGM Graphic Segments. For CLEVEL 3, the maximum aggregate size of a Graphic Segment is 1-Mbyte (1,048,576 bytes). For CLEVEL 5, 6 and 7, the maximum aggregate size of a Graphic Segment is 2-Mbytes (2,097,152 bytes).

5.11.2 If an implementation in its native mode of operation has the capability to generate any type of graphic annotations, it must support the generation and inclusion of CGM Graphic Segments within the NSIF files that it creates.

5.11.3 The implementation must preclude the generation of an NSIF file containing CGM Graphic Segments that exceed the maximum interpretation ranges for specific CLEVELs as stated above.

5.11.4 For all CLEVELs, the implementation must be able to interpret and use any CGM Graphic Segment compliant with the ISO BIIF Profile for Computer Graphics Metafile, Version 01.00 (BPCGM01.00).

5.11.5 For all CLEVELs, the implementation must not create any CGM Graphic Segment that is not compliant with ISO BIIF Profile for Computer Graphics Metafile, Version 01.00 (BPCGM01.00).

5.12 Text Segment Criteria

5.12.1 Text Format (TXTFMT) Standard American Standard Code for Information Interchange (ASCII) (STA). The implementation must unpack and display text data in all Text Segments marked with the text format code for standard ASCII (STA). For text files formatted as STA:

5.12.1.1 Contents are composed of none other than the following BCS characters: Line Feed (0X0A), Form Feed (0X0C), Carriage Return (0X0D), and Space (0X20) to Tilde (0X7E).

5.12.1.2 All lines are separated by Carriage Return/Line Feed (CR/LF) pairs, where the first character of the next line (if present) immediately follows the Line Feed character.

5.12.1.3 Text data is presented as a contiguous file, with each permitted BCS character immediately following the other.

5.12.1.4 Text data begins with the first, or left-most character of the text, followed by subsequent characters, as read from left to right.

5.12.1.5 No field delimiters or special characters are used to designate the end of the text data. If more than one Text Segment is included in the NSIF file, the last character of the first Segment is followed by the first character of the next Segment's Subheader.

5.12.2 Text Format (TXTFMT) Universal Multiple (1 Octet Coded) Character Set (UCS) Transformation Format 1 (UT1). The implementation must unpack and display text data in all Text Segments marked with the text format code for Universal Multiple Character Set (UCS) Transformation Format 1 (UT1). For Text Segments formatted as UT1:

5.12.2.1 Contents are composed of none other than the following characters: Line Feed (0X0A), Form Feed (0X0C), Carriage Return (0X0D), and Space (0X20) to Tilde (0X7E) and No break Space (0XA0) through small "y" with dieresis (0XFF).

5.12.2.2 All lines are separated by Carriage Return/Line Feed (CR/LF) pairs, where the first character of the next line (if present) immediately follows the Line Feed character.

5.12.2.3 Text data is presented as a contiguous file, with each permitted character immediately following the other.

5.12.2.4 Text data begins with the first, or left-most character of the text, followed by subsequent characters, as read from left to right.

5.12.2.5 No field delimiters or special characters are used to designate the end of the text data.

5.12.2.6 If more than one Text Segment is included in the NSIF file, the last character of the first Segment is followed by the first character of the next Segment's Subheader.

5.12.3 Text Format (TXTFMT) Message Text Format (MTF)
For Text Segments identified by the TXTFMT field value Message Text Format (MTF), the implementation must be able to unpack and display the text data. The implementation may optionally pass the text data to an MTF capable application for further processing and proper display, in accordance with STANAG 5500. For text files formatted as MTF:

5.12.3.1 Contents are composed of none other than the following characters: Line Feed (0x0A), Form Feed (0X0C) and Space (0X20) to Tilde (0X7E).

5.12.3.2 Line endings are identified by either a sixty-nine character count or the use of double solidus ("//" 0x2F). This is a continuous stream of characters wherein a "//" denotes the end of a line. In other words, if the stream is parsed for readability then a CR/LF pair is substituted for the "//".

5.12.3.3 Text data is presented as a contiguous file, with each permitted character immediately following the other.

5.12.3.4 Text data begins with the first, or left-most character of the text, followed by subsequent characters, as read from left to right.

5.12.3.5 No field delimiters or special characters are used to designate the end of the text data.

5.12.3.6 If more than one Text Segment is included in the NSIF file, the last character of the first Segment is followed by the first character of the next Segment's Subheader.

5.12.4 Universal Multiple Octet Coded Character Set (UCS)
Transformation Format 8 (UTF-8) Subset (U8S). For text segments identified by the text format code for U8S (either 1-byte or 2-byte encoded), the implementation must be able to unpack and display the text data.

5.12.4.1 Contents are composed of none other than the following BCS characters: Line Feed (0x0A), Form Feed (0x0C) Carriage Return (0x0D), and space (0x20) through tilde (0x7E) and No break space (0xC2 A0) through small "y" with diaeresis (0x C3 BF).

5.12.4.2 All lines are separated by carriage return/line feed (CR/LF) pairs, where the first character of the next line (if present) immediately follows the line feed character.

5.12.4.3 Text data is presented as a contiguous file, with each permitted character immediately following the other.

5.12.4.4 Text data begins with the first, or left-most character of the text, followed by subsequent characters, as read from left to right.

5.12.4.5 No field delimiters or special characters are used to designate the end of the text data.

5.12.4.6 When more than one text segment is included in the NSIF file, the last character of the first segment is followed by the first character of the next segment's subheader.

5.12.5 Other
For text files associated with any text format code other than STA, UT1, or MTF (e.g. Universal Multiple (2-Octet Coded) Character Set (U8S)), the NSIF implementation must not be adversely affected when attempting to display the text data.

5.12.6 Unpack
An implementation must be able to interpret an NSIF file containing 0 to 32 Text Segments. The maximum size of the text portion in any Text Segment must not exceed 99,999 characters.

5.12.7 Pack
Implementations that support the packing of Text Segments must do so within the criteria established for unpacking.

5.13 Data Extension Segment (DES) Criteria

5.13.1 DES Pack
NSIF files packed by NSIF compliant implementations that do not use DESs must fill the Number of Data Extension Segments (NUMDES) Field with "000". Implementations that require the insertion of DES shall fill the NUMDES field, Length of $n^{th}$ DES Subheader (LDSHn) Field, and the Length of $n^{th}$ DES Reserved Field (LDn) with the associated values determined by the length of the DES. Implementations that are required to pack NISF Files with DESs shall be tested for the proper generation of the associated data defined by the DES. Only DESs approved by the NSIF Custodian are allowed as shown in the DES portion of the NSIF Support Data Extension Registry.

5.13.2 DES Unpack

5.13.2.1 It is optional for unpack capable implementations be able to interpret NSIF files containing DESs. If IUT does not interpret or support a particular DES, it should not adversely affect or halt the application's processes.

5.13.2.2 Upon unpack of an NSIF file where the NUMDES field contains a count other than 000, and the DES is unknown, the implementation must at least properly interpret the other legal components of the NSIF file. Implementations that require the use of DES shall be tested for the interpretation of the associated data defined by the DES. The structure and identifier for all allowed controlled DES(s) is under management of the STANAG 4545 Custodian.

5.13.2.3 Specific test criteria for each DES is included with the description of the DES in the NSIF Registry.

5.14 Reserved Extension Segment (RES) Criteria

5.14.1 Only STANAG 4545 Custodian approved RES are allowed as shown in the Reserved Extension Segment (RES) portion of the NSIF Support Data Extension Registry.
Note: There are no approved RESs as of the publishing of this document.

5.14.2 Upon receipt of an NSIF file where the Number of Reserved Extension Segments (NUMRES) Field contains a count other than 000, and the RES is unknown, the implementation must otherwise properly interpret the other legal components of the NSIF file.

5.15 Overlay and Display Level (DLVL) Criteria

5.15.1 Implementations must support non-destructive overlays. Overlays must not be merged with other displayable Segments in a way that precludes them from being separated from it.

5.15.2 Implementations must render overlays in the order indicated by their DLVL, not by their relative position within the NSIF structure.

5.15.3 The non-transparent pixel value of a higher numbered DLVL replaces the values of lower numbered DLVL when rendered.

5.15.4 Overlays must be positioned at the correct row and column relative to the origin of the object.

5.15.5 All DLVL values within an NSIF file are unique.

5.16 Attachment Level (ALVL) Criteria

5.16.1 The Image or Graphic Segment in the NSIF file having the lowest numerical DLVL shall have ALVL zero.

5.16.2 An implementations capable of packing overlay Segments within an NSIF file must at least support packing the Segments using ALVL 000. Segments may have ALVL of 000 or greater. Unpack capable implementations must support ALVLs over the range of 000 to 998.

5.16.3 The ALVL of a Segment must be equal to the DLVL of the Segment to which it is attached, or it must be set to 000 (meaning unattached).

5.16.4 The DLVL of a Segment must always be numerically greater than its own ALVL. In other words, it must be attached to a previous segment. It may not be attached to itself or a following segment.

5.16.5 An implementation must properly display and position all Segments based on the specified row and column offset from the item's origin point to which it is attached.

5.16.6 As an option, the implementation may use the parent-child relationship among its attached Segments so that the Segments may be treated together as a group for certain operations such as moving, rotating, and displaying. Implementations will be tested for each operation it supports that makes use of ALVL.

5.17 Tagged Record Extension (TRE) Criteria

5.17.1 The following criteria pertain to all NSIF implementations.

5.17.1.1 Upon receipt of an NSIF file that contains information in TREs, the implementation must at least properly interpret and display the other legal displayable (image and graphic) segments of the NSIF file.

5.17.1.2 Only those TREs registered with the STANAG 4545 Custodian may be used (see Annex E. NSIF Approved Support Data Extension Listing).

5.17.1.3 Each tagged record extension consists of three required fields: TRETAG, (6 byte unique extension identifier), TREL (length of extension in bytes), and TREDATA (data according to the specification of the extension).

5.17.1.4 A sequence of TREs can appear in the UDHD and/or XHD fields of the NSIF file Header or any Segment Subheader UDHD or UDID, IXSHD, and SXSHD, OR TXSHD fields.

5.17.1.5 A sequence of TREs can also appear in a TRE_OVERFLOW DES. This condition will be identified by the three-byte numeric overflow field of the UDHD, XHD, UDID, IXSHD, and SXSHD, or TXSHD field containing the sequence number of the DES into which the tags are placed.

5.17.1.6 When the TRE carries data that is associated with the NSIF file as a whole, it must appear in the NSIF File Header or an associated TRE_OVERFLOW DES. If the extension carries data associated with a Segment in the NSIF file, it must appear in the Subheader of that Segment or an associated TRE_OVERFLOW DES.

5.17.1.7 A TRE must be included in its entirety within the specific Header or Subheader field selected to contain it, or it must be placed in its entirety in a TRE_OVERFLOW DES.

5.17.1.8 All data in fields designated as alphanumeric (BCS-A) must be left justified and padded with spaces as necessary to fill the field.

5.17.1.9 All data in numeric (BCS-N) fields must be right justified and padded with leading zeroes as necessary to fill the field.

5.17.1.10 All required fields must be present and must contain valid data as defined in the NSIF TRE documents.

5.17.2 <u>Profile for Imagery Archive Extensions (PIAE)</u>
The following criteria pertain to those implementations that support the creation and use of PIAEs.

5.17.2.1 The PIAPR extension may only be placed in the NSIF file header extension fields UDHD, XHD or a TRE Overflow DES for the file header. Only one PIAPR extension is permitted per file.

5.17.2.1.1 Systems or applications that possess a need to submit NSIF data to an archive must include a PIAPR TRE.
5.17.2.1.2 NSIF implementations will produce the C-edition of PIAPR (PIAPRC) for all instances of this extension.

5.17.2.2 The PIAIM extension may only be placed in the NSIF image subheader extension fields UDID, IXSHD or the TRE_OVERFLOW DES for the image subheader. Only one PIAIM extension is permitted per image subheader.

5.17.2.2.1 Systems or applications that possess a need to submit NSIF data to an archive must include a PIAIM TRE.

5.17.2.2.2 NSIF implementations will produce the C-edition of PIAIM (PIAIMC) for all instances of this extension.

5.17.2.3 Receiving Archives will review each incoming file for sound structure and completeness.

5.17.3 <u>Airborne Support Data Extensions (ASDE)</u>
The following criteria pertain to those implementations that support the creation and use of Airborne SDEs. Sources that produce NSIF files with Airborne SDEs, must create a compliant file within the bounds of applicable standards.

5.17.3.1 Required ASDEs

The following table identifies required ASDEs for specific sensor or image categories.

**Table C-2. Sensor/Image Category ASDE Requirements**

| TITLE | TRE NAME | SAR | EO/VIS | IR | MSI | MTI-only |
|---|---|---|---|---|---|---|
| Aircraft Information | ACFTB | Req. | Req. | Req. | Req. | Req. |
| Additional Image Identification | AIMIDB | Req. | Req. | Req. | Req. | Opt. |
| Multispectral/Hyperspectral Band Parameters | BANDSB | N/A | Opt. | Opt. | Opt. | N/A |
| Image Block Information | BLOCKA | Opt. | Opt. | Opt. | Opt. | N/A |
| Exploitation Usability Optical Information | EXOPTA | N/A | Opt. | Opt. | Opt. | N/A |
| Exploitation Related Information | EXPLTB | Opt. | N/A | N/A | N/A | Opt. |
| Airborne SAR Mensuration Data | MENSRB | Opt. | N/A | N/A | N/A | N/A |
| Mensuration Data | MSTGTA | Opt. | N/A | N/A | N/A | N/A |
| Mission Target | MSTGTA | Opt. | Opt. | Opt. | Opt. | Opt. |
| Patch Information | PATCHB | Opt. | N/A | N/A | N/A | N/A |
| Rapid Positioning Data | RPC00B | Opt. | Opt. | Opt. | Opt. | N/A |
| EO-IR Sensor Parameters | SENSRB | N/A | Req. | Req. | Req. | N/A |
| Secondary Targeting Information | SECTGA | Opt. | Opt. | Opt. | Opt. | Opt. |
| Stereo Information | STEROB | N/A | Opt. | Opt. | Opt. | N/A |

(EO implies visible, panchromatic, IR, MSI, HSI, etc., MSI implies HSI.)

NOTE: Each TRE ends with a revision letter; the initial definition used the revision letter "A", and revised extensions have names ending in "B" ("C", "D", etc.) as revisions are approved.

5.17.4 Geospatial Support Data Extensions (GeoSDE)

The following criteria apply to those implementations that support NSIF files containing Geospatial Support Data Extension (GeoSDE).

5.17.4.1 Pack criteria for GeoSDE implementations

5.17.4.1.1 Implementations that produce NSIF files with GeoSDEs must pack these NSIF files in compliance with STANAG 4545 and Table C-3 identifies the criteria for determining the specific GeoSDE Controlled Extensions (CEs) applicable to a File Header or Image Segment of a given category and representation. All criteria identified under the criteria sets must be met in order to identify the applicable set of CEs to be used.

**Table C-3. Categories of Image/Matrix/Grid Data**

<table>
<tr><td colspan="3">Categories of Image/Matrix/Grid Data</td><td colspan="3">TRE to be include in the Image subheader</td></tr>
<tr><th>Data Type</th><th>ICAT</th><th>IREP</th><th>ACCURACY</th><th>LOCATION</th><th>SOURCE</th></tr>
<tr><td>Raster Map</td><td>MAP</td><td>MONO, RGB, RGB/LUT, YCbCr</td><td rowspan="3">ACCPO AND /OR ACCHZ & ACCVT</td><td rowspan="3">GEOPS + conditionally PRJPS + one of GEOLO, MAPLO, GRDPS, REGPT + optionally BNDPL</td><td>SOURCE</td></tr>
<tr><td>Matrix Data (Digital Terrain Elevation Models and Others)</td><td>DTEM, MATR</td><td>NODISPLY, NONO, RGB/LUT</td><td>SOURCE or SNSPS</td></tr>
<tr><td>Geo-referenced Imagery</td><td>VIS, LS, TI, FL, RD, EO, OP, HR, HS, CP, BP, SAR, IR, MS</td><td>MONO, RGB, RGB/LUT, MULTI, YCbCr</td><td>SNSPS</td></tr>
<tr><td rowspan="2">Auxiliary Data (Legend, color patch, Location grid)</td><td>LEG, PAT</td><td>MONO, RGB, RGB/LUT</td><td rowspan="2"></td><td rowspan="2">GRDPS</td><td rowspan="2"></td></tr>
<tr><td>LOCG</td><td>NODISPLY</td></tr>
</table>

5.17.4.1.2 GeoSDE Auxiliary Data

Table C-4 identifies auxiliary data and the related GeoSDE. An Image Segment containing raster map, elevation, image, or matrix data may be associated with one or more Image Segments in the NSIF file containing auxiliary data. Auxiliary data may consist of the Legend (LEG), the color-PATch of a map (PAT), or a LOCation Grid (LOCG). The associated Image Segments contain no GeoSDEs themselves, but rather refer to the information in the associated Image Segment's GeoSDEs (for example, the coordinates of a LOCG are expressed in the absolute reference system defined by the GEOPS SDE of the Image Segment to which it is associated).

**Table C-4. Auxiliary Data**

| Auxiliary Data | ICAT | IREP | Related Extension | Comment |
|---|---|---|---|---|
| Legend | LEG | MONO<br>RGB<br>RGB/LUT | SOURC | |
| Color-Patch | PAT | MONO<br>RGB<br>RGB/LUT | SOURC | |
| Location Grid (Cartographic) | LOCG | NODISPLY | GRDPS | ISUBCAT1= CGX<br>ISUBCAT2 = CGY |
| Location Grid (Geodetic) | LOCG | NODISPLY | GRDPS | ISUBCAT1 = GGX<br>ISUBCAT2 = GGY |

5.17.4.2 Unpack criteria for GeoSDE Implementations
The following are the unpack criteria for the GeoSDEs when they appear in the NSIF file.

5.17.4.2.1 Positional Accuracy Extension (ACCPO) Criteria. The implementation must process all required fields in the Positional Accuracy Extension (ACCPO) extension that contain valid data as defined in DIGEST 2.1.

5.17.4.2.1.1 The implementation must interpret the number of positional accuracy sets within a given NSIF file and allow the user to access and exploit the information contained in each set.

5.17.4.2.1.2 The implementation must correctly interpret and exploit the following information to the precision defined in the extension:

- Absolute Horizontal Accuracy
- Absolute Vertical Accuracy
- Relative Horizontal Accuracy
- Relative Vertical Accuracy

5.17.4.2.1.3 The implementation must not display or mensurate using precision values greater than those provided in the ACCPO extension.

5.17.4.2.1.4 The implementation must correctly display the units of measure for the different accuracy values as defined by the ACCPO extension.

5.17.4.2.1.5 The implementation must recognize and correctly associate accuracy information, both horizontal and vertical, as defined by the NUM_ACPO and LON and LAT coordinate pairs for up to 99 accuracy sets.

5.17.4.2.1.6 The implementation must allow the user to display and/or exploit the positional accuracy data if, and only if, that information is contained in the extension.

5.17.4.2.2 Geo Positioning Information Extension (GEOPS) Criteria. The implementation must process all required fields in the GEOPS extension that contain valid data as defined in DIGEST 2.1.

5.17.4.2.2.1 The implementation must process the information contained in the required name fields and present the user, upon request, with the:

- Coordinate System Type
- Ellipsoid Name
- Vertical Datum Name
- Geodetic Datum Name
- Cartographic Grid Code
- Grid Description
- Grid Zone Number
- Projection Name

5.17.4.2.2.2 The implementation must exploit the coded values, if the name field is null, for the:

- Ellipsoid
- Vertical Datum
- Geodetic Datum
- Projection

This information must be presented to the user upon request.

5.17.4.2.2.3 For each projection parameter, the implementation will define what the parameter is, using DIGEST 2.1, Part 3, and the false easting and northing of that parameter.

5.17.4.2.2.4 The implementation must display the units of measure for the coordinates in the data set.

5.17.4.2.3 Local Geographic Coordinate System Extension (GEOLO) Criteria
The implementation must process all required fields in the Local Geographic Coordinate System Extension (GEOLO) that contain valid data as defined in DIGEST 2.1, Annex D.

5.17.4.2.3.1 The implementation must exploit the GEOLO extension for all image, raster or matrix data rectified consistently with geographic coordinate systems.

5.17.4.2.3.2 The implementation must allow the user to access and exploit the Reference Origin information contained in the GEOLO extension.

5.17.4.2.3.3 The implementation must return a coordinate pair for any pixel in the image. The precision with which the coordinate pair is returned must not exceed that of the extension itself.

5.17.4.2.4 Local Cartographic (Grid-Based) Coordinate System Extension (MAPLO) Criteria The implementation must process all required fields in the Local Cartographic (Grid-Based) Coordinate System Extension (MAPLO) that contain valid data as defined in DIGEST 2.1.

5.17.4.2.4.1 The implementation must exploit the MAPLO extension for all image, raster or matrix data rectified consistently with cartographic coordinate systems.

5.17.4.2.4.2 The implementation must allow the user to access and exploit the data density for the East to West (E to W) and North to South (N to S) direction.

5.17.4.2.4.3 The implementation must denote the units of measurement for the data density.

5.17.4.2.4.4 The implementation must allow the user to access and exploit the Easting and Northing of the reference origin.

5.17.4.2.4.5 The implementation must return a coordinate pair for any pixel in the image. The precision with which the coordinate pair is returned must not exceed that of the extension itself.

5.17.4.2.5 Map Source Description Extension (SOURC) Criteria
The implementation must process all required fields in the Map Source Description Extension (SOURC) that contain valid data as defined in DIGEST 2.1.

5.17.4.2.5.1 The implementation must identify and allow the user access to the number of source descriptions.

5.17.4.2.5.2 The implementation must, for each source:

- Identify and allow the user access to the Image ID
- Identify and allow the user access to the number of Legend Images
- Identify and allow the user access to the number of insets
- Identify and allow the user access to the Series Designator
- Identify and allow the user access to the Source Edition Number

5.17.4.2.5.3 Identify and allow the user access to the full name of the Source Document

5.17.4.2.6 Grid Reference Data Extension (GRDPS) Criteria
The implementation must process all required fields in the Grid Reference Data Extension (GRDPS) that contain valid data as defined in DIGEST 2.1.

5.17.4.2.6.1 The implementation must allow the user to process the information contained in the NUMGRDS field and make the information available to the user for processing.

5.17.4.2.6.2 For each location grid (LOCG) the implementation will:

- Define the elevation of the LOCG in meters
- Identify the correct grid image file and allow the user to read in the image file and have it available for processing
- Identify the ratio of image pixels to grid elements for each column
- Identify the ratio of image pixels to grid elements for each row
- Identify the column and row number of the origin of the LOCG
- Identify the number of rows and columns in the LOCG
- Allow the user to exploit all of the information contained in the extension.

5.17.4.2.6.3 The implementation must allow the user to exploit all of the information in the extension

5.17.4.2.6.4 The implementation must allow the user to derive the geographic location of each pixel in the grid image.

5.17.4.2.6.5 The implementation must notify the user of the density of the grid image file.

5.17.4.2.6.6 The implementation must allow the user to thin the density of the grid image file.

5.17.4.2.7 Registration Point Extension (REGPT) Criteria
The implementation must process all required fields in the Registration Point Extension (REGPT) that contain valid data as defined in DIGEST 2.1.

5.17.4.2.7.1 The implementation must inform the user of the number of registration points available.

5.17.4.2.7.2 For each registration point present, the implementation must:

- Provide a point identification number
- Provide the LAT/LON or Easting/Northing of the registration point
- Provide the elevation of the registration point
- Provide the row and column number of the registration point
- Provide the local Z coordinate of the registration point

5.17.4.2.7.3 The implementation must allow the user to exploit the registration points in order to adjust the overall image and improve accuracy of the data.

5.17.4.2.8 Horizontal Accuracy Extension (ACCHZ) Criteria
The implementation must process all required fields in the Horizontal Accuracy Extension (ACCHZ) that contain valid data as defined in DIGEST 2.1.

5.17.4.2.8.1 The implementation must interpret the number of horizontal accuracy sets within a given frame file and allow the user to access and exploit the information contained in each accuracy set.

5.17.4.2.8.2 The implementation must correctly interpret and exploit:

- Absolute Horizontal Accuracy
- Relative Horizontal Accuracy

5.17.4.2.8.3 The implementation must correctly display the units of measure for the different accuracy values as defined by the ACCHZ extension.

5.17.4.2.8.4 The implementation must recognize and correctly associate accuracy information as defined by the NUM-ACPO and LON and LAT coordinate pairs for up to 99 accuracy sets.

5.17.4.2.8.5 The implementation must allow the user to display and/or exploit the horizontal accuracy data if, and only if, that information is contained in the extension.

5.17.4.2.8.6 The implementation must display the horizontal accuracy values only to the precision to which it is defined by the extension.

5.17.4.2.9 Vertical Accuracy Extension (ACCVT) Criteria
The implementation must process all required fields in the Vertical Accuracy Extension (ACCVT) that contain valid data as defined in DIGEST 2.1.

5.17.4.2.9.1 The implementation must interpret the number of vertical accuracy sets within a given frame file and allow the user to access and exploit the information contained in each accuracy set.

5.17.4.2.9.2 The implementation must correctly interpret and exploit:

- Absolute Vertical Accuracy
- Relative Vertical Accuracy

5.17.4.2.9.3 The implementation must correctly display the units of measure for the different accuracy values as defined by the ACCVT extension.

5.17.4.2.9.4 The implementation must recognize and correctly associate accuracy information as defined by the NUM-ACPO and LON and LAT coordinate pairs for up to 99 accuracy sets.

5.17.4.2.9.5 The implementation must allow the user to display and/or exploit the vertical accuracy data if, and only if, that information is contained in the extension.

5.17.4.2.9.6 The implementation must display the vertical accuracy values only to the precision to which it is defined by the extension.

5.17.4.2.10 Sensor Parameters Data Extension (SNSPS) Criteria
The implementation must process all required fields in the Sensor Parameters Data Extension (SNSPS) that contain valid data as defined in DIGEST 2.1.

## 5.18 Usability Criteria

The NSIF documents do not currently identify requirements for the usability of systems that implement NSIF. A system can be in technical compliance with the standards, yet not be well suited for use in its targeted user environment. The following usability criteria are based upon observations made during past compliance tests. In addition, a discussion of the minimum NSIF reader capabilities is contained in AEDP-4, Annex A. These criteria will be evaluated by the NSIF Test Facility and will be discussed in the test report, but they will not be considered compliance criteria for registration. The purpose is to expand the sponsor's awareness of human factor considerations. The NSIF Test Facilities encourage sponsors to provide additional usability test criteria that they would like to have evaluated during compliance testing of their system.

5.18.1 Target Audience Description
The developer has prepared a target audience description for the system and used it in the design and development of the system, an appropriate Human Factors Engineering and Safety (HFE) evaluation conducted by the developer.

5.18.2 Operator’s Manual/Product Specification
An up-to-date operator's manual for the system is available at the time of compliance testing. In addition, the product specification that defines the specific implementation requirements will be provided.

5.18.3 Consistent User Interface
The system has a consistent user interface with the appearance of a single integrated application. There is no perception of needing to exit and enter multiple routines to handle NSIF operations. Once the application starts, there is no need to enter commands at the operating system prompt.

5.18.4 Header/Subheader Defaults
The system does not require an operator entry for each and every NSIF file Header or Subheader field value. It provides some mechanism for establishing default values and automatic calculation of values where appropriate.

5.18.5 Header/Subheader Edit
The system must not use hard coded Header/Subheader defaults that cannot be changed without recoding and recompiling the program. The system provides edit capabilities for Header/Subheader values in a controlled manner depending on the access privilege of different levels of users.

5.18.6 Screen and Imagery Board Correspondence

A method is provided to handle the circumstances when the screen or other rendering device does not have the same pixel display capacity as the imagery processing board. There are clear procedures for setting up the appropriate parameters for proper image display. There is a means to alert the operator that the rendered image may be cropped because the display device does not handle the full image size as received (when no roaming or panning capability is provided).

5.18.7 Automatic Rendering

NSIF message components are automatically displayed according to the NSIF file header values without operator intervention; i.e. the operator is not required to read NSIF header values and manually place components of the file for display.

5.18.8 Direct Text Entry

The system allows for the entry of text without the operator needing to be aware of special procedures for insuring only the NSIF STA, UT1, and MTF set of characters (without special word processing control codes, but with proper CR/LF line terminators) enter into the NSIF file.

5.18.9 User Alerts

There is some method to alert the operator that text or image comment fields are within the NSIF file being viewed and there is a convenient means to view the components. The operator is alerted to other aspects regarding the NSIF file being viewed that are not readily apparent from the image display (such things as: user-defined or extended data is included in the file; the image has color components but has been modified for display on a monochrome system; security codewords are included in the NSIF file Headers; particular components could not be properly parsed or interpreted, etc.).

5.18.10 File Security Classification

Pack capable implementations when generating an NSIF file shall perform a logical examination of the NSIF file Header, Image, Graphic, Text, DES, and RES Subheader Security Classification fields (FSCLAS, ISCLAS, SSCLAS, TSCLAS, DECLAS, and RECLAS) to ensure the FSCLAS contains a security classification level (T denoting Top Secret, S denoting Secret, C denoting Confidential, R denoting Restricted, or U denoting NATO Unclassified) equal to or higher than any ISCLAS, SSCLAS, TSCLAS, DECLAS, or RECLAS. The intent of this criterion is to ensure FSCLAS is properly labeled and no Image, Graphic, Text or TRE Segment(s) contains classification levels higher than the overall security classification of the NSIF file. If, on examination, FSCLAS fails this test there is a classification error, the implementation shall alert the operator and not proceed. Operator intervention shall be required to enable the NSIF file packing operation to continue.

5.18.11 Automatic Assist

The system assists the operator in preparing NSIF files that do not exceed the established boundary conditions for a specific CLEVEL. There is no excess dependence on operator knowledge or procedures to ensure only compliant NSIF files are packed.

# ANNEX D Test Criteria for JPEG 2000 Data in STANAG 4545[1]

FOREWORD

The International Standard (IS) 12087-5:1998, Basic Image Interchange Format (BIIF) provides guidance for creating profiles of BIIF. The NATO Secondary Imagery Format Version 01.01 (NSIF01.01) is a profile of BIIF intended to promote interoperability for the exchange of Imagery among military Command, Control, Communications, Computers and Intelligence ($C^4I$) systems. The NSIF01.01 profile of BIIF allows for the compression of image data using the provisions of ISO/IEC 15444, JPEG 2000 Part 1: Image coding system: Core coding system and in some limited functional cases (e.g. Large Volume Streaming Data (LVSD) applications) a subset of the capabilities provided in Part 2: Extensions. The BIIF Profile for JPEG 2000 Version 01.10 (BPJ2K01.10) is the applicable implementation profile for the JPEG 2000 compression of digital imagery, incorporating the compressed digital imagery into NSIF files, and exchanging them within the $C^4I$ user community.

This document provides the test requirements for determining conformance with BPJ2K01.10. The objective is to promote interoperability between NSIF01.01 encoders and decoders implementing BPJ2K01.10 by testing these systems for conformance with this profile. Conformance testing is the testing of a candidate implementation for the existence of specific characteristics required by a standard or a specific profile of a standard. It involves testing the capabilities of an implementation against both the conformance requirements in the relevant standard and the statement of the implementation's capability.

The test requirements, criteria, and measures specified in this document are derived from the detailed requirements and conformance criteria found in the BPJ2K01.10 and the provisions of ISO/IEC 15444-4 Information technology – JPEG 2000 image coding system - Part 4: Conformance testing.

This test requirements document was cooperatively developed between the ISO and the North Atlantic Treaty Organization (NATO). It is submitted in support of NATO Standardization Agreement (STANAG) 4545 and the NSIF01.01 Profile of BIIF, and has been promulgated by the Chairman of the Military Agency for Standardization (MAS) under the authority vested in him by the NATO Military Committee.

[1] Note that different and/or additional criteria may apply to JPEG 2000 compressed data in file structures other than STANAG 4545 files.

INTRODUCTION

ISO/IEC Standard 15444-1: JPEG 2000 Part 1: Image coding system: Core coding system, an international standard for compression of imagery data, has been adopted as an imagery compression option for use within the North Atlantic Treaty Organization (NATO) Secondary Imagery Format (NSIF) profile of ISO/IEC Standard 12087-5, Basic Image Interchange Format (BIIF). ISO/IEC 15444-1 is a standard that describes an image compression system that allows great flexibility, not only for the compression of images but also for access into the codestream. The codestream provides a number of mechanisms for locating and extracting portions of the compressed image data for the purpose of retransmission, storage, display, or editing. This access allows storage and retrieval of compressed image data appropriate for a given application without decoding.

The BIIF Profile for JPEG 2000, Version 01.10 (BPJ2K01.10) is the profile applicable to NSIF for the JPEG 2000 compression of digital imagery. All compliant NSIF decoders are required to decode all compliant data within the implemented NSIF complexity level that is compressed within the limits of the BPJ2K01.10 profile (any JPEG 2000 Part 1 Profile-1 codestream). All compliant NSIF encoders capable of producing JPEG 2000 compressed data are required to do so strictly within the limits of the BPJ2K01.10 profile for the implemented NSIF complexity level. Only NSIF decoders with an explicit requirement to do so, must be compliant with the additional features from ISO 15444 Part 2: Extensions required to support LVSD systems using the LPJE preferred JPEG 2000 encoding profile defined in BPJ2K01.10.

The BPJ2K01.10 defines five Preferred JPEG 2000 Encoding Profiles: NPJE, EPJE, TPJE, LPJE, and SPJE. Note that the only preferred encoding profile not approved for use in NITF/NSIF is the SPJE encoding, which is currently only approved for use in the STANAG 7023 NPIF data format. In addition, it should be noted that the LPJE profile should only be used with data generated by LVSD systems requiring the additional capabilities from ISO 15444 Part 2: Extensions which are specifically supported by that Preferred Encoding Profile. LVSD systems which do not expressly require the extensions from Part 2 of the JPEG 2000 standard should continue to use the Part 1-compliant Preferred Encoding(s) which best meet their particular system requirements (NPJE, EPJE, and/or TPJE, or even ISO Profile-1). For additional information regarding the usage and applicability of LPJE encoding, consult the BPJ2K01.10 documentation. Whenever possible, an NSIF-compliant encoding implementation should limit itself to the use of the Part 1-compliant Preferred Encoding Profiles – NPJE, EPJE, and/or TPJE – though compliance with ISO Profile-1 is also an option if none of the Preferred Encodings meet the system requirements. To support the widest level of interoperability within dissemination architectures (which may include several levels of collection systems (encoders), libraries/distributors (transcoders), and end users (decoders)), all NSIF-compliant JPEG 2000 decoders must be able to unpack JPEG 2000 compressed NITF/NSIF files containing any Part 1-compliant codestream. Note that NPJE, EPJE, and TPJE encodings are more restrictive than what is allowed under Part 1; therefore, a compliant decoder must support a broader capability than a compliant encoder; see the BPJ2K01.10 for more detailed information on this point.

Several portions in the NSIF file format contain information directly related to the JPEG 2000 codestream content. The BPJ2K01.10 shows how the JPEG 2000 codestream fits into the context of the overall NSIF file format and provides information about file header, image subheader and Tagged Record Extension (TRE) settings that are related to the JPEG 2000 codestream content for which NSIF implementations are required to comply.

## 1. SCOPE

This document specifies the test requirements and criteria to be achieved to claim conformance to the BIIF Profile of JPEG 2000, version 01.10. It provides a framework for applying the abstract test suites provided in ISO/IEC 15444-4, defining additional abstract test suites specific to BPJ2K01.10, specifying executable test cases, and establishing the procedures to be followed during conformance testing.
This document provides test requirements to establish conformance for:

- NSIF file structure and field population when using JPEG 2000
- Decoding codestreams compliant with JPEG 2000 Part 1, Profile-1 constraints (includes NPJE, EPJE and TPJE)
- Encoding within the JPEG 2000, Part 1, Profile-1 constraints
- Encoding within the NSIF Preferred JPEG 2000 Encoding (NPJE) constraints
- Encoding within the Exploitation Preferred JPEG 2000 Encoding (EPJE) constraints
- Encoding within the Tactical Preferred JPEG 2000 Encoding (TPJE) constraints
- Application and use of the J2KLRA Tagged Record Extension (TRE)
- NSIF complexity level constraints when using JPEG 2000
- Parsing, chipping, and repackaging JPEG 2000 codestreams
- Decoding JP2 file format

## 2. REFERENCES/TERMS/DEFINITIONS

Terms and definitions applicable to this Annex are included in Annex C.4. ACRONYMS, TERMS AND DEFINITIONS.

## 3. CONFORMANCE

The following section describes the features and functions that an Implementation Under Test (IUT), when applicable, will be tested against and must successfully perform in order to achieve NITFS/BIIF/NSIF (NBN) JPEG 2000 (J2K) conformance. The test requirements are divided into five areas; encode, decode, repack, file format and NSIF/NITF Clevel constraints.

ISO/IEC 15444-4 describes conformance for JPEG 2000 decoders in terms of a system of guarantees. These guarantees serve to discourage encoders from producing codestreams that will be exceedingly difficult or impossible for a decoder to process, to encourage decoders to provide quality images from any reasonable codestream, and to encourage use of the flexibility and scalability of JPEG 2000 codestreams.

Profiles define a subset of technology, from ITU-T T.800 | ISO/IEC 15444-1: JPEG 2000, to meet the needs of a given application with limits on parameters within a selected technology. Profiles limit bitstreams. Encoders achieve quality guarantees for particular decoders by encoding bitstreams that meet a particular profile definition. Decoders provide guarantees (JPEG 2000 Cclass) regarding their ability to interpret codestreams in part or in whole. Codestream profiles are designed with Cclass guarantees in mind to enhance decoder performance.

Compliance classes (Cclass) define guarantees of a given level of image quality for a decoder and guidance for encoders to produce codestreams that are easily decodable by compliant decoders. Essentially, if a JPEG 2000 encoder produces a codestream with certain properties, then a decoder of a certain Cclass will be capable of producing an image with some defined level of quality. The compliance class of a decoder is based solely on passing certain tests. The tests in ISO/IEC 15444-4 are designed to require a compliant decoder to be capable of decoding all codestreams with a set of defined properties.

## 3.1 Profiles and compliance classes

Two profiles are defined in ITU-T T.800 | ISO/IEC 15444-1 Amendment 1, labeled Profile-0 and Profile-1. The two profiles describe bitstream constraints for an ITU-T T.800 | ISO/IEC 15444-1 encoder. Profile-0 is a subset of Profile-1. Hence, any implementation capable of decoding Profile-1 test streams shall be capable of passing the compliance tests for Profile-0 of the same Cclass. The BPJ2K01.10 requires decoder compliance with Profile-1, which includes the encodings for NPJE, EPJE, and TPJE, all of which are subsets of Profile-1. The compliance classes define levels of image quality guarantees for decoders and guidance for encoders to produce codestreams that are easily decodable by compliant decoders. Cclass guarantees increase with the increasing Cclass numbers. For compliance issues related to the use of the LPJE Preferred Encoding Profile, see the appropriate sections of BPJ2K01.10.

## 3.2 Decoders

NSIF compliant decoders are required to fully decode any JPEG 2000 Part-1, Profile-1 file produced within the constraints of the NSIF complexity level implemented by the NSIF decoder. In order to determine the accuracy of NSIF JPEG 2000 decoders, the implementation must have the means to save decoded images into an uncompressed NBN file. This will allow for comparison between the decoded image and a reference test image. For decoder compliance issues related to the use of the LPJE Preferred Encoding Profile, see the appropriate sections of BPJ2K01.10.

## 3.3 Encoders and codestreams

ITU-T T.800 | ISO/IEC 15444-1 Amendment 1 describes two restricted profiles (Profile-0 and Profile-1) that provide limits or constraints concerning the parameter ranges and information placement in a codestream. Since codestream limitations may also adversely affect scalability and interoperability, the smallest possible number of limitations are imposed by these profiles. Encoders may also be required to conform to certain guarantees in particular application areas of interest that are outside the scope of IEC/ISO 15444-4. Accordingly, BPJ2K01.10 NSIF imposes constraints on encoders required to comply with the NPJE, EPJE and TPJE rules for use in NSIF files. For encoder and codestream compliance issues related to the use of the LPJE Preferred Encoding Profile, see the appropriate sections of BPJ2K01.10.

## 3.4 Implementation compliance statement

Evaluation of compliance for a particular implementation requires a statement of the options that have been implemented. This will allow the implementation to be tested for compliance against only the relevant requirements of BPJ2K01.10. Such a statement is called an Implementation Compliance Statement (ICS). The ICS shall contain only options within the framework of requirements specified in the ISO/IEC 15444-1 Standard and the BPJ2K01.10 or in the case of LVSD collection, dissemination, and exploitation systems generating/using LPJE compliant codestreams, certain additional requirements addressed in ISO/IEC 15444-2 Extensions. Examples of these can be found in ISO/IEC 15444-4 Annex E for decoders and Annex F for encoders.

## 3.5 Abstract Test Suites

The Abstract Test Suites (ATS) define general tests for sub-systems of ISO/IEC 15444-1. In addition to the ATS available in ISO/IEC 15444-4, ATS specific to the BPJ2K01.10 will be used to provide the basis for developing executable test cases tailored to the test requirements specified herein. Each ATS will include the following parts, as defined in ISO/IEC 15444-4, Annex C:

- Test Purpose: What the test requirement is.
- Test Method: The procedures to be followed for the given ATS.
- Reference: The portion of the ISO document that is being tested by the given ATS.

## 3.6 Reference Decoder

The Reference decoder is used for the evaluation of compliance of an encoder. The reference decoder is defined in ITU-T T.800 | IS 15444-5. The reference decoder has been developed by the ISO WG 1 committee for the purpose of guidance for implementers and data providers. The reference decoder must be able to decode all encoder-developed codestreams that fall within the Profile-1 limitations of the encoding.

For LVSD systems requiring the use of the LPJE Preferred Encoding Profile, a Reference Decoder must not only be able to decode all encoder-developed codestreams that fall within the Profile-1 limitations of the encoding, but it must be able to decode any LPJE-compliant codestream. Additional requirements relating to the use of LPJE are addressed in BPJ2K01.10."

## 3.7 Encoder Compliance

It is not a requirement to implement and/or support all possible encoding modes or capabilities of JPEG 2000. However, multiple encoding modes and capabilities may be desirable for many applications. It is not a requirement for an encoder to produce any specific codestream. However, any codestream "(except in the case of LVSD-related systems using LPJE encodings) that is produced must be a legal Profile-1 JPEG 2000 codestream, or a profile/encoding that is a legal subset codestream of Profile-1 such as Profile-0, or the NPJE, EPJE or TPJE encodings. The encoded files can be verified by decoding the codestream with a validated reference decoder.

## 3.8 Decoder Compliance Classes

Compliant implementations of the decoder are not required to decode each codestream in its entirety but are required to guarantee performance up to one of a collection of Profiles and Compliance Classes. These guarantees are directly connected with the resources required by a decoder. They may be interpreted as a contract by the implementation to recover, decode and transform a well-defined minimal subset of the information contained in any codestream. This contract is described in a manner that scales with the Cclass. The contract may be exploited by content providers to optimize recovered image quality over a family of decoders according to their known Compliance Classes. For a given Profile, decoder guarantees are expressed in terms of several parameters including decoded image dimensions, H (height) and W (width), and a number of components, C, for the Cclass. The parameters are not dependent on the codestream that is actually being decoded. ISO/IEC 15444-4, Annex C defines the parameters and the classes for which compliance claims may be made and tested. When decoding NPJE, EPJE, and TPJE constrained codestreams, decoders are required to fully decode such codestreams within their NBN complexity level capabilities. For all other JPEG 2000 Part 1 Profile-1 codestreams contained in NBN files, the decoder must also correctly decode the file up to the limits of the complexity level capabilities.

When decoding LPJE constrained codestreams, decoders are required to fully decode such codestreams within their NBN complexity level capabilities. In addition, if a decoder has an express requirement to decode LPJE compliant codestreams, then it must be capable of decoding any LPJE compliant codestream, which also includes any NPJE, EPJE, TPJE, and Profile-1 compliant codestream. Specific ATS and Cclass requirements associated with the testing of LPJE compliant decoders will be developed on a programmatic basis to support the specific needs of IUTs designed to handle data generated by LVSD systems.

# 4. TEST REQUIREMENTS

## 4.1 Encode JPEG 2000, Part 1 Profile-1 Compliant Codestreams

This section describes the features and constraints of a J2K codestream created by an implementation under the BIIF Profile for JPEG 2000. An IUT must correctly encode image arrays into J2K codestreams according to 1) the normative references and 2) the options available in the user interface of the IUT. The IUT's user interface shall not present options that are beyond the limits of J2K features described in the normative references. The J2K codestream shall exhibit all options selected in the user interface by the operator. Implementers can find the J2K codestream syntax, marker segment definitions, filtering process and coding algorithms in ISO/IEC 15444-1:2002 JPEG 2000 Image Coding System Part 1. Listed below are test requirements or criteria of Profile-1 of ISO/IEC 15444-1:2002 JPEG 2000 Part 1: Image Coding Systems. Additional amendments and corrigenda to ISO/IEC 15444-1 must be consulted as well. Also, the test requirements for Profile-1 must be further refined so as to be within the bounds of the BPJ2K01.10 Section 7 and the additional limitations of BPJ2K01.10 Appendices D (for NPJE), E (for EPJE), and F (for TPJE), as appropriate to the encoder implementation's specific compliance requirements – see sections 4.1, 4.2, 4.3, 4.4, 4.5, and 4.6 below for encoding profile-specific information.

### 4.1.1 SOC Marker.

The SOC marker (0xFF4F) is the first marker segment in the J2K codestream. The SOC Marker only appears in the main header of the J2K codestream.

### 4.1.2 SOT Marker.

The SOT marker (0xFF90) is the first marker segment in each tile part of the J2K codestream. The SOT marker only appears in tile headers of the J2K codestream.

#### 4.1.2.1 Psot Field Population

For every SOT, except the last SOT in the J2K codestream, the Psot field of the SOT marker segment cannot be equal to 0 (Psot $\neq 0$). This provision applies to Profile-1, NPJE, and EPJE preferred encoding profiles. However, the TPJE preferred encoding requires all SOT markers, including the last, to have their Psot fields set to non-zero values; this restriction may be lifted in future revisions of BPJ2K01.10 to bring TPJE more in line with the NPJE and EPJE encoding profiles. (In any case, all Psot field values must contain valid values for the codestream in question.) Please note that it is highly recommended that all codestreams formed for use in NITF/NSIF files have all of the SOT marker segments use non-zero Psot values. See BPJ2K01.10 for further guidance and explanation.

#### 4.1.3 SOD Marker.

The SOD marker (0xFF93) is the last marker segment of each tile part header in the J2K codestream. The SOD marker only appears in tile headers of the J2K codestream.

#### 4.1.4 EOC Marker.

The EOC marker (0xFFD9) is the last marker segment in the J2K codestream. The EOC marker only appears in the bitstream portion of the J2K codestream.

#### 4.1.5 SIZ Marker.

The SIZ marker (0xFF51) is the second marker segment in the main header of the J2K codestream. The SIZ marker only appears in the main header of the J2K codestream.

#### 4.1.6 COD Marker.

The COD marker (0xFF52) appears once and only once in the main header of the JPEG 2000 codestream and optionally appears no more than once in the first tile-part header of any tile. COD markers do not appear in the bitstream of the J2K codestream.

#### 4.1.7 COC Marker.

The COC marker (0xFF53) appears no more than once per component within the main header or in the first tile-part header of a given tile in the J2K codestream. Use of COC markers is optional. COC markers do not appear in the bitstream of the J2K codestream.

#### 4.1.8 RGN Marker.

The RGN marker (0xFF5E) only appears, no more than once per component, in the main header or first tile-part header of a given tile in the J2K codestream. Use of RGN markers is optional. RGN markers do not appear in the bitstream of the J2K codestream. When present in the main header, the RGN marker applies to all tiles except those with a RGN marker segment. When used in a tile-part header, applies only to one component within that tile.

##### 4.1.8.1 RGN Marker Limit.

The SPrgn value is less than or equal to 37.

#### 4.1.9 QCD Marker.

There is one, and only one, QCD marker (0xFF5C) in the main header of the J2K codestream and no more than one in the first tile-part header of any tile. QCD markers do not appear in the bitstream of the J2K codestream.

4.1.10 QCC Marker.

The QCC marker (0xFF5D) appears no more than once per component, within the main header or in the first tile-part header of a given tile in the J2K codestream. Use of QCC markers is optional. QCC markers do not appear in the bitstream of the J2K codestream.

4.1.11 POC Marker.

POC markers (0xFF5F) appear only once in any main or tile-part header of the J2K codestream. POC markers do not appear in the bitstream of the J2K codestream. The POC marker must appear in a tile-part header before the packets which it describes. Use of POC markers or Progression order changes in a J2K codestream is optional.

4.1.12 TLM Marker.

TLM markers (0xFF55) only appear in the main header of the J2K codestream. Use of TLM markers is optional.

NITF/NSIF implementers should take note that if the encoder implementation being developed restricts itself to using a single TLM (possible only with NPJE and TPJE), the maximum number of tiles in a codestream is restricted to 16382. This limitation may drive NITF/NSIF segmentation earlier than expected based on the segmentation rules of NSIF01.01 itself. Use of multiple TLMs removes this consideration for most practical situations – the limit on the number of tiles in a codestream then being 65535.

4.1.13 PLM Marker.

PLM markers (0xFF57) only appear in the main header of the J2K codestream. Use of PLM markers is optional.

4.1.14 PLT Marker.

PLT markers (0xFF58) only appear in the tile header of the J2K codestream. The PLT marker must appear in any tile-part header before the packets whose lengths they describe. Use of PLT markers is optional.

4.1.15 PPM Marker.

PPM markers (0xFF60) only appear in the main header of the J2K codestream. If present, all packet headers are present in the main header of the J2K codestream. Use of PPM markers is optional. PPT markers (0xFF61) do not appear in the same J2K codestream with PPM markers.

4.1.16 PPT Marker.

A PPT marker (0xFF61) only appears in the tile header of the J2K codestream. The PPT marker must appear in any tile-part header before the packets whose headers are contained in the PPT appear. Use of

PPT markers is optional. PPT markers (0xFF61) do not appear in the same J2K codestream with PPM markers.

4.1.17 SOP Marker.

A SOP marker (0xFF91) only appears in the bitstream portion of the J2K codestream. Use of SOP markers is optional. The SOP marker may be used in front of each packet, but shall not be used unless indicated in the proper COD marker segment. Note that whether or not an SOP marker is used, the Nsop field must be incremented for each packet in the bitstream. If packet headers are moved into a PPT or PPM marker segment, then the SOP markers may appear immediately before the packet bodies in the bitstream.

4.1.18 EPH Marker.

If indicated by the proper COD marker segment, the EPH marker (0xFF92) appears in the J2K codestream. If EPH markers are signaled, they must appear for every packet header. If the packet headers are moved into a PPM or PPT marker segment, then the EPH markers shall appear after the packet headers in the PPM or PPT marker segments.

4.1.19 CRG Marker.

The CRG marker (0xFF63) only appears in the main header of the J2K codestream. Use of CRG markers is optional. Only one CRG may appear in the main header and it applies for all tiles. This marker segment has no effect on decoding the codestream; it is for informational purposes only.

4.1.20 COM Marker.

COM markers (0xFF64) only appear in the main header of the J2K codestream. Use of COM markers is optional. COM markers are informational only, and repeat as many times as desired in the main or tile-part headers. This marker segment has no effect on decoding the codestream.

4.1.21 Visually Lossless/Lossy and 9-7I Filtering Compression.

9-7 Irreversible wavelet (9-7I) filtering is used with lossy compression; this includes Visually Lossless (VL) compression as well as visually lossy compression.

4.1.22 Numerically Lossless and 5-3R Filtering Compression

The 5-3 Reversible wavelet (5-3R) filtering is used with Numerically Lossless (NL) compression. When fully decoded, by a reference J2K decoder implementation, the reversible numerically lossless encoded J2K codestream, is identical to the original image data.

4.1.23 Progression Order.

A Profile-1 compliant J2K codestream may contain any of the allowed progression orders, to include: LRCP, RLCP, RPCL, PCRL, and CPRL. ($0 \leq$ Progression Order field value $\leq 4$.)

**Table D-1. Progression Order Field**

| Sgcod, Spcoc, Ppoc Values (bits) MSN LSN | Progression Order |
|---|---|
| 0000 0000 | Layer – resolution level – component – position progression (LRCP) |
| 0000 0001 | Resolution level- layer – component – position progression (RLCP) |
| 0000 0010 | Resolution level – position – component – layer progression (RPCL) |
| 0000 0011 | Position – component – resolution level – layer progression (PCRL) |
| 0000 0100 | Component – position – resolution level – layer progression (CPRL) |
| | All other values reserved |

Note the following restrictions: The NPJE encoding requires the use of the LRCP progression order. The EPJE encoding requires the use of the RLCP progression order. The TPJE encoding requires the use of either the LRCP or the RLCP progression orders. A Profile-1 compliant codestream can use any of the progression orders.

4.1.24 Wavelet Decomposition.

A Profile-1 compliant J2K codestream may contain between 0 and 32 decomposition levels. ($0 \leq N_{levels}$ field value $\leq 32$.)

4.1.25 Profile Indicator.

The J2K codestream contains a profile indicator value that signals Profile-1, or a subset of Profile-1. Rsiz = 0000 0000 0000 0010 indicates a Profile-1 compliant codestream. The only currently defined subset of Profile- 1 is Profile-0. Rsiz = 0000 0000 0000 0001 indicates Profile-0 compliant codestream. For additional information concerning Profile-0 and Profile-1, see Appendix C of BPJ2K01.10.

4.1.26 Layer Numbers.

A Profile-1 compliant J2K codestream may contain between 1 and 65535 quality layers. ($1 \leq N_{layers}$ field value $\leq 65535$.)

4.1.27 Empty Tiles.

A compliant JPEG 2000 codestream may contain empty tiles. This is normally the case when Block Masking is used in the NBN file containing the J2K compressed codestream. J2K decoders and ELT packages must be able to handle the presence of empty tiles in the codestream, whether Block Masking is indicated or not.

4.1.28 Components (Bands).

The J2K codestream contains a maximum of 16384 components. ($1 \leq$ Csiz field value $\leq 16384$.)

4.1.29 Codeblock Size.

The codeblock height and width value is 64 or less. ($xcb \leq 6$, $ycb \leq 6$ .)

4.1.30 Encode LL Resolution.

Profile-1 has a requirement for the LL subband resolution. The restriction states that for each tile in the image, the final LL subband from the decomposition process (most reduced resolution level) must be less than or equal to 128x128 for the first four components (bands) of the image (bands 0 to 3). This means that the lowest resolution version of an untiled image (image is comprised of one large tile) must be no larger than 128x128 for the first four image components (bands) in the codestream. For this reason, it is highly recommended that encoders produce tiled codestreams, so that the potential need for excessive levels of decomposition is not required in order to meet this encoding constraint.

4.1.31 Multiple Codestreams.

Only one J2K codestream can exist in any given NSIF Image Segment. If the full image plane to be compressed cannot fit into a single J2K codestream (or due to NSIF segmentation rules cannot fit into a single Image Segment) then the image plane must be broken up into multiple J2K codestreams with each individual codestream being placed in its own NSIF Image Segment. When this occurs, the compression parameters used to compress each codestream must be identical, i.e. quantization, layering, wavelet transform filter choice, number of decomposition levels, progression order, tiling size, codeblock size, precinct size, and coding defaults. This is to ensure uniformity of the image presentation when the individual Image Segment codestreams are stitched together for display in an ELT software package, and to facilitate spatial chipping operations which may occur across Image Segment boundaries.

4.1.32 Minimal J2K File Formats.

NBN Profile-1 files that encoded based on the constraints of BPJ2K01.10 Section 7 and Appendix A may contain JP2 header boxes. Note: It is encouraged that JP2 header boxes only be used if needed to support the decoding of the codestream for applying such features as LUTs, channel definition, colour transforms, band ordering, associated XML metadata, etc.

4.2 Encode NPJE Constrained Codestreams

An IUT correctly encodes image arrays into J2K codestreams within the criteria of ISO/IEC 15444-1:2002 JPEG 2000 Image Coding System, listed in section 6.1, and the NSIF/BIIF/NITF (NBN) Preferred JPEG 2000 Encoding (NPJE) constraints described in BPJ2K01.10 appendix D and summarized below.

4.2.1 L-R-C-P Progression Order.

J2K codestreams are in Layer-Resolution-Component-Position progression order. (Progression Order field = 0x0) All packets for the 1st tile layer resolution and component, followed by the 2nd component, then the 3rd component and so on through all components. This is followed by all packets for the 1st tile, layer, 2nd resolution and all its components. Figure D-1. LRCP Packet Order.

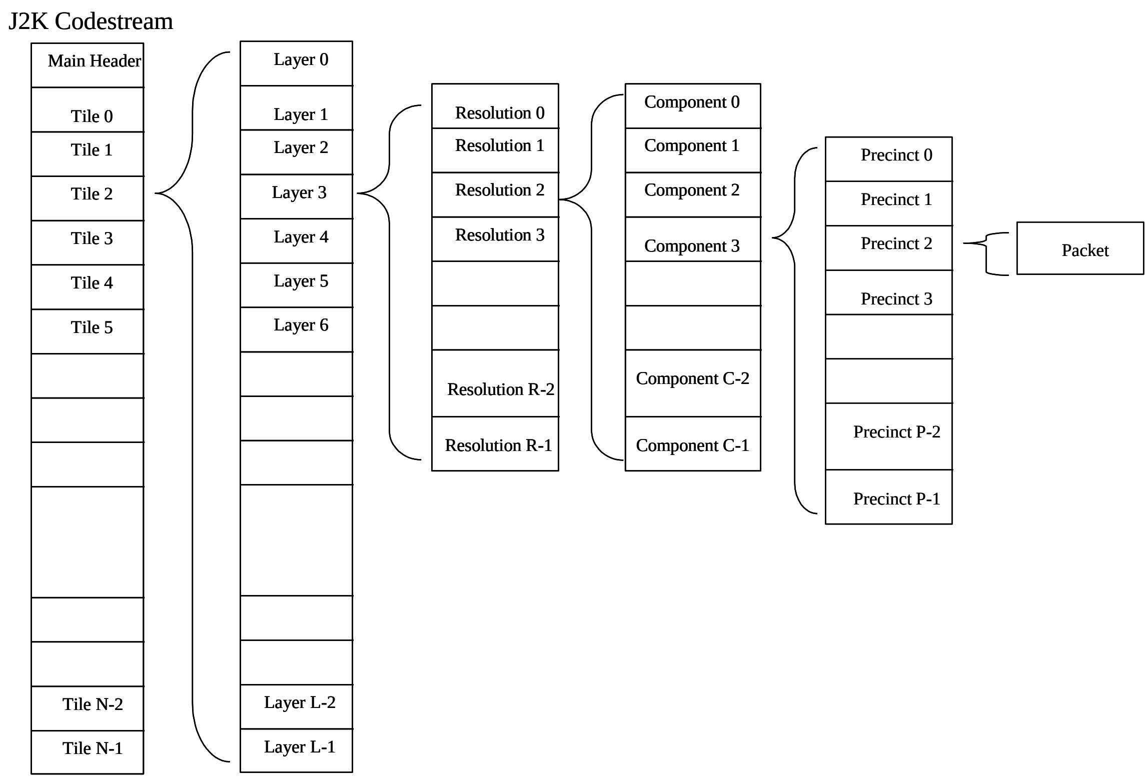



**Figure D-1. LRCP Packet Order**

4.2.2 Wavelet Decomposition.

The J2K codestream contains 5 wavelet decomposition levels. ($N_{levels}$ = 5.)

4.2.3 Profile Indicator.

The J2K codestream contains a profile indicator (value Rsiz = 0000 0000 0000 0010), which signals Profile-1, or any other value that indentifies a subset of Profile-1. The currently defined subset of Profile-1 is Profile-0, identified with an Rsiz value equal to 0000 0000 0000 0001.

4.2.4 Layer Numbers.

It is recommended, but not required, that NPJE-compliant J2K codestreams contained in NBN files use the suggested number of quality layers and associated notional bit rate limits as defined in BPJ2K01.10 Appendix D. However, the interoperability of some systems may be impaired if a different number of layers are used. Note that a given scene’s content might, through efficient compression, lead to a case where the final few layers in the codestream are not actually populated, or populated but with nothing other than empty packets. This is perfectly acceptable. J2K layer bit rate limits are not “targets” in the true sense of the term, they are simply limits used to bin packets into notional quality layers. To promote the widest possible interoperability within multi-national C4I architectures in place today, it is highly recommended that a NPJE-compliant encoder use the recommended number of layers per BPJ2K01.10 Appendix D, though, again, there is no express requirement to do so, and systems developers are free to optimize the encoding parameters used with their particular systems as long as the codestreams formed comply with the NPJE profile.

4.2.4.1 Layers in Numerically Lossless NPJE Codestreams

It is recommended that a NPJE codestream contain 20 quality layers for numerically lossless compression per BPJ2K01.10 Appendix D.

4.2.4.2 Layers in Visually Lossless NPJE Codestreams

It is recommended that a NPJE codestream contain 19 quality layers for visually lossless compression per BPJ2K01.10 Appendix D.

4.2.4.3 Layers in Lossy NPJE Codestreams

It is recommended that a NPJE codestream contain 19 or fewer quality layers for original lossy compression (as considered separately from visually lossless compression) per BPJ2K01.10 Appendix D.

4.2.5 Tiling.

Size of the J2K reference tiles is 1024 x 1024 (XTsiz=YTsiz= 0x0400).

4.2.6 Tile Parts.

Encoded tiles within the J2K codestream contain only one tile-part. Tile parts must appear in raster order within the J2K codestream without omission or repetition. It is highly recommended that the Psot ≠ 0 for the last SOT in the codestream.

4.2.7 Fixed Tiles.

All tiles within the J2K codestream have the same number of components, layers, and decomposition levels.

4.2.8 TLM Markers.

J2K codestream contains TLM markers, with Stlm = 0100 0000 (i.e. ST = 0 and SP = 1)

4.2.9 PLT Markers.

J2K codestream contains PLT markers. For each tile, one PLT marker is required for each layer.

4.2.10 Codeblock Size.

J2K codestream utilizes a codeblock size of 64 by 64 (xcb=ycb=6).

4.2.11 Image Offset.

Image offset values (XOsiz and YOsiz) are set to zero.

4.2.12 Tile Offset.

Tile offset values (XTOsiz and YTOsiz) are set to zero.

4.2.13 Component Scaling/Separation.

The sample separation values, XRsiz and YRsiz, are set to "1".

4.2.14 J2KLRA Tagged Record Extension (TRE).

J2KLRA TRE is optional for inclusion in NBN NPJE files containing J2K encoded data. Detailed requirements for the structure of the J2KLRA are described in section 4.11 of this document.

4.2.15 Precinct Size.

NITFS/BIIF/NSIF (NBN) NPJE files do not contain precincts.

4.2.16 Minimal J2K File Formats.

NBN NPJE files will not contain JP2 header boxes.

4.2.17 Main Header Markers

J2K main header only contains the following markers; SOC, SIZ, COD, COM, QCD, QCC and TLM. Use of the COM or QCC marker is optional.

4.2.18 Marker Order MH

Main Header markers are in the following order: SOC, SIZ. Then the following markers may be placed in any order after the SIZ marker: COD, COM, QCD, QCC and TLM.

4.3 Encode EPJE Constrained Codestreams

An IUT correctly encodes image arrays into J2K codestreams within the criteria of ISO/IEC 15444-1:2002 JPEG 2000 Image Coding System, listed in section 6.1, and the Exploitation Preferred JPEG 2000 Encoding (EPJE) constraints described in BPJ2K01.10 Appendix E and summarized below.

4.3.1 Progression Order.
J2K codestreams are in Resolution-Layer-Component-Position (RLCP) progression order. (Progression Order field = 0x1).

4.3.2 Wavelet Decomposition.

The J2K codestream contains 5 wavelet decomposition levels. ($N_{levels}$ = 5.)

4.3.3 Profile Indicator.

The J2K codestream contains a profile indicator value of 2 to denote compliance with Profile-1. (Rsiz field value = 0000 0000 0000 0010)

4.3.4 Numbers of Layers.

It is recommended, but not required, that EPJE-compliant J2K codestreams contained in NBN files use the suggested number of quality layers and associated notional bit rate limits as defined in BPJ2K01.10 Appendix E. However, the interoperability of some systems may be impaired if a different number of layers are used. Note that a given scene's content might, through efficient compression, lead to a case where the final few layers in the codestream are not actually populated, or populated but with nothing other than empty packets. This is perfectly acceptable. J2K layer bit rate limits are not "targets" in the true sense of the term, they are simply limits used to bin packets into notional quality layers. To promote the widest possible interoperability within multi-national C4I architectures in place today, it is highly recommended that an EPJE-compliant encoder use the recommended number of layers per BPJ2K01.10 Appendix E, though, again, there is no express requirement to do so, and systems developers are free to optimize the encoding parameters used with their particular systems as long as the codestreams formed comply with the EPJE profile.

4.3.4.1 Layers in Numerically Lossless EPJE Codestreams

It is recommended that an EPJE codestream contain 20 quality layers for numerically lossless compression per BPJ2K01.10 Appendix E.

4.3.4.2 Layers in Visually Lossless EPJE Codestreams

It is recommended that an EPJE codestream contain 19 quality layers for visually lossless compression per BPJ2K01.10 Appendix E.

4.3.4.3 Layers in Lossy EPJE Codestreams

It is recommended that an EPJE codestream contain 19 or fewer quality layers for original lossy compression (as considered separately from visually lossless compression) per BPJ2K01.10 Appendix E.

4.3.5 Tiling.

Size of the J2K reference tiles is 1024 x 1024 (XTsiz=YTsiz= 0x0400)

4.3.6 Tile-parts.

4.3.6.1 Number of Tile-Parts per Tile

Encoded tiles within the J2K codestream contain six tile-parts per tile with each tile-part containing packets from a single resolution within the tile.

4.3.6.2 Ordering of Tile-Parts

All tile-parts, across all tiles, for a given resolution are contiguous and in raster order within the J2K codestream.

4.3.6.3 Tile-Part SOT Marker Population

For the SOT in each tile-part, $Psot \neq 0$ and $TNsot \neq 0$.

4.3.6.4 Fixed Tiles.

All tiles within the J2K codestream have the same number of components, layers, and decomposition levels. Furthermore, if a large collected image operation is segmented into multiple NBN Image Segments in order to place the entire image plane in a single NBN file (and each segment is JPEG 2000 compressed), then each individual JPEG 2000 codestream (one per Image Segment) is recommended to maintain the same tile size, number of components, number of layers, and number of decomposition layers across the multiple codestreams in order to facilitate cross-segment spatial chipping operations. Note that it is additionally implied in this case, that each of the NBN Image Segments in this multi-segment example should not contain any overlap pixels between the Image Segments, so that the tiles in separate codestreams can be thought of as occurring in a single raster order.

4.3.7 TLM Markers.

J2K codestream contains TLM markers with Stlm = 0110 0000 (i.e. ST = 2 and SP = 1).

4.3.8 PLT Markers.

J2K codestream contains PLT markers. There is exactly one PLT per tile-part (i.e. one PLT per resolution per tile).

4.3.9 Codeblock Size.

J2K codestream utilizes a codeblock size of 64 by 64 (xcb=ycb=6).

4.3.10 Image Offset.

Image offset values (XOsiz and YOsiz) are set to zero.

4.3.11 Tile Offset.

Tile offset values (XTOsiz and YTOsiz) are set to zero.

4.3.12 Component Scaling/Separation.

The sample separation values, XRsiz and YRsiz, are set to "1".

4.3.13 J2KLRA Tagged Record Extension (TRE).

J2KLRA TRE is included in NBN EPJE files containing J2K encoded data. Detailed requirements for the structure of the J2KLRA are described in section 4.11 of this document.

4.3.14 Precinct Size.

NBN EPJE files do not contain precincts.

4.3.15 Minimal JPEG 2000 File Formats.

NBN EPJE file will not contain JP2 header boxes.

4.3.16 Main Header Markers

J2K main header only contains the following markers; SOC, SIZ, COD, COM, QCD, QCC and TLM. Use of the COM or QCC marker is optional.

4.3.17 Marker Order MH

Main Header markers are in the following order: SOC, SIZ. Then the following markers may be placed in any order after the SIZ marker: COD, COM, QCD, QCC and TLM.

## 4.4 Encode TPJE Constrained Codestreams

An IUT correctly encodes image arrays into J2K codestreams within the criteria of ISO/IEC 15444-1:2002 JPEG 2000 Image Coding System, listed in section 6.1, and the Tactical Preferred JPEG 2000 Encoding (TPJE) constraints described in BPJ2K01.10 Appendix F and summarized below.

### 4.4.1 Progression Order.

J2K codestreams are in Layer-Resolution-Component-Position (LRCP) progression order. (Progression Order field = 0x0) or J2K codestreams are in Resolution-Layer-Component-Position (RLCP) progression order. (Progression Order field = 0x1).

### 4.4.2 Wavelet Decomposition.

The J2K codestream contains 5 to 9 wavelet decomposition levels. ($N_{levels}$ = 5 to $N_{levels}$ = 9)

### 4.4.3 Profile Indicator.

The J2K codestream contains a profile indicator value of 2. (Rsiz field value = 0000 0000 0000 0010))

### 4.4.4 Number of Layer.

This AEDP makes no specific recommendation as to the number of quality layers to use in TPJE-compliant J2K codestreams contained in NBN files; implementation examples illustrating notional choices for number of quality layers and associated notional bit rate limits as defined in BPJ2K01.10 Appendix F, but no particular set of choices is defined for use with TPJE. Whatever number of layers and associated bit rates are chosen for use with a given system-specific implementation of a TPJE J2K codestream, a given scene's content might, through efficient compression, lead to a case where the final few layers in the codestream are not actually populated, or populated but with nothing other than empty packets. This is perfectly acceptable. J2K layer bit rate limits are not "targets" in the true sense of the term, they are simply limits used to bin packets into notional quality layers. Systems developers are free to optimize the encoding parameters used with their particular systems as long as the codestreams formed comply with the TPJE profile.

4.4.4.1 Layers in TPJE Codestreams

The J2K codestream contains 1 to 20 quality layers for Numerically Lossless (NL), Visually Lossless (VL), and Lossy (L) TPJE-compliant compressed imagery.

#### 4.4.5 Tiling and Chipping

TPJE restricts tile sizes to powers of two and only tile-based chipping is allowed. Size of the J2K reference tiles may be 256 x 256 (XTsiz=YTsiz= 0x0100), 512 x 512 (XTsiz=YTsiz= 0x0200) or 1024 x 1024 (XTsiz=YTsiz= 0x0400).

#### 4.4.6 Tile-parts.

##### 4.4.6.1 Number of Tile-Parts per Tile

Encoded tiles within the J2K codestream can contain one to ten tile-parts per tile as progression order permits.

##### 4.4.6.2 Tile-Part SOT Marker Population

For the SOT in each tile-part, Psot $\neq 0$.

##### 4.4.6.3 Fixed Tiles.

All tiles within the J2K codestream have the same number of components, layers, and decomposition levels. Furthermore, if a large collected image operation is segmented into multiple NBN Image Segments in order to place the entire image plane in a single NBN file (and each segment is JPEG 2000 compressed), then each individual JPEG 2000 codestream (one per Image Segment) is recommended to maintain the same tile size, number of components, number of layers, and number of decomposition layers across the multiple codestreams in order to facilitate cross-segment spatial chipping operations. Note that it is additionally implied in this case, that each of the NBN Image Segments in this multi-segment example should not contain any overlap pixels between the Image Segments, so that the tiles in separate codestreams can be thought of as occurring in a single raster order.

#### 4.4.7 TLM Markers.

Multiple TLM markers are permitted.

#### 4.4.8 PLT Markers.

At least one PLT marker segment is required. Applications shall use no more than one PLT per layer (they might use less) unless marker segment length constraints require more.

#### 4.4.9 Codeblock Size.

J2K codeblock sizes can be 32x32 (xcb=ycb=5), 32x64 (xcb=5,ycb=6), 64x32 (xcb=6, ycb=5) or 64x64 (xcb=ycb=6).

#### 4.4.10 Image Offset.

Image offset values (XOsiz and YOsiz) are set to zero.

#### 4.4.11 Tile Offset.

Tile offset values (XTOsiz and YTOsiz) are set to zero.

#### 4.4.12 Component Scaling/Separation.

The sample separation values, XRsiz and YRsiz, are set to "1".

#### 4.4.13 J2KLRA Tagged Record Extension (TRE).

J2KLRA TRE is included in TPJE NBN files containing J2K encoded data. Detailed requirements for the structure of the J2KLRA are described in section 4.11 of this document.

#### 4.4.14 Precinct Size.

NBN TPJE files contain maximal precincts (i.e., no spatial segmentation of subbands) are used.

#### 4.4.15 Minimal JPEG 2000 File Formats.

NBN TPJE file will not contain JP2 header boxes.

#### 4.4.16 Main Header Markers

J2K main header only contains the following markers; SOC, SIZ, COD, COM, QCD, QCC and TLM. Use of the COM or QCC marker is optional.

#### 4.4.17 Marker Order MH

Main Header markers are in the following order: SOC, SIZ. Then the following markers may be placed in any order after the SIZ marker: COD, COM, QCD, QCC and TLM.

### 4.5 Encode LPJE Constrained Codestreams

The LPJE (LVSD Preferred JPEG 2000 Encoding) profile defines the preferred JPEG 2000 compression encoding for Large Volume Streaming Data (LVSD) sensors. (LVSD systems are sometimes referred to as Wide Area Persistent Surveillance systems.) For LPJE compliant systems, an IUT correctly encodes image arrays into J2K codestreams within the criteria of ISO/IEC 15444-1:2002 JPEG 2000 Image Coding System, listed in section 6.1, and the LVSD Preferred JPEG 2000 Encoding (LPJE) constraints described in BPJ2K01.10 Appendix G and summarized below.

LPJE is a superset of the ISO/IEC 15444-1 Profile-1, NPJE, EPJE, TPJE, and SPJE encodings, which means that any JPEG 2000 codestream compressed to any preferred encoding in BPJ2K01.10 is also an LPJE compressed image. LPJE however, offers a wider range of compression options than any other preferred encoding. It is possible to create LPJE compliant files that lie outside the boundaries defined within Profile-1 in JPEG 2000 Part 1; therefore, strictly NSIF01.01 compliant systems will not be able to decode all possible LPJE files. Only LPJE compliant systems must be able to decode all possible LPJE files.

Note that portions of the LPJE profile were first published in AEDP-8 before being published as part of BPJ2K01.10. In the event of any discrepancy between AEDP-8 and BPJ2K01.10, the text of BPJ2K01.10 takes precedence.

4.5.1 Progression Order

LPJE allows any progression order. Furthermore, LPJE allows for the changing of progression order within a codestream via a POC marker segment.

4.5.2 Wavelet Decomposition

For specific implementation guidance relating to the Resolution Scalability and the number of wavelet decomposition levels to use in creating an LPJE compliant codestream, consult Section G.2.1.1 of BPJ2K01.10.

4.5.3 Profile Indicator

An LPJE compliant codestream will use the particular profile indicator value that best describes the particular codestream. If the LPJE codestream happens to be compliant with Profile-0, then the Rsiz = 0000 0000 0000 0001. If the LPJE codestream happens to be compliant with Profile-1 (but not Profile-0), then the Rsiz = 0000 0000 0000 0010. If the LPJE codestream is not compliant with Profile-1, then the Rsiz = 0000 0000 0000 0000 to indicate the use of the No Restrictions profile (Profile-NR).

4.5.4 Number of Layers

For specific implementation guidance relating to Quality Scalability and the number of quality layers to use in creating an LPJE compliant codestream, consult Section G.2.1.2 of BPJ2K01.10.

4.5.5 Tiling, Parsing, and Chipping

For specific implementation guidance relating to Tiling, Parsing, and Chipping in the creation and use of an LPJE compliant codestream, consult Section G.2.1.3 of BPJ2K01.10.

4.5.6 Region of Interest Encoding

The LPJE profile supports region of interest encoding. For specific implementation guidance relating to ROI encoding in LPJE codestreams, consult Section G.2.1.4 in BPJ2K01.10.

4.5.7 Repackaging and Transcoding

The possible complexity achievable with LPJE encoded codestreams means that specialized handling is required to perform codestream repackaging and transcoding operations. For further implementation guidance consult Section G.2.2 of the BPJ2K01.10.

4.5.8 Tile-Parts

LPJE codestreams can use multiple tile-parts per tile, however, there is no implicit association between resolution level and tile-part within LPJE.

4.5.9 Fixed Tiles

Since an LPJE codestream can make use of Region of Interest encoding and indeed may not even use tiles at all, in favor of a precinct-based encoding, there is no universally applicable requirement to maintain fixed tiles. However, if a LPJE codestream uses tiles, then it is highly recommended that the baseline compression parameters applied to each tile, unless overridden by a ROI encoding option, should be identical across all tiles in the codestream to support uniformity of presentation to the user across the entire image plane.

In addition, if the NBN file contains multiple Image Segments which when taken together form a single large image operation, then it is further recommended that the tile-based encoding parameters used in the individual (presumably tile-based) LPJE codestreams (one in each NBN Image Segment) should also be the same, so as to facilitate cross-segment chipping, repackaging, and transcoding operations. In addition, there should be no overlap or gaps in coverage between the Image Segments, such that the implicit tile raster across the entire multi-segment image plane is maintained.

4.5.10 TLM Markers

Multiple TLM markers are permitted.

4.5.11 PLT Markers

Multiple PLT marker segments may be used per tile.

4.5.12 Codeblock Size

For guidance on codeblock sizing issues consult Section G.4.3.1 of BPJ2K01.10.

4.5.13 Image Offset

Image offset values (XOsiz and YOsiz) can be any value between 0 and ($2^{32} – 2$).

4.5.14 Tile Offset

If the LPJE codestream uses tiles, the tile offset values (XTOsiz and YTOsiz) can be any value between 0 and ($2^{32} – 2$).

4.5.15 Component Scaling/Separation

The sample separation values, XRsiz and YRsiz, can be set to any value between 1 and 255.

4.5.16 J2KLRA Tagged Record Extension (TRE)

The J2KLRA TRE is included in LPJE NBN files containing JPEG 2000 encoded data. Detailed requirements for the structure of the J2KLRA TRE are described in section 4.11 of this document.

4.5.17 Precinct Size

LPJE codestreams can use precincts of any size allowed by ISO/IEC 15444-1.

4.5.18 Minimal JPEG 2000 File Formats

NBN LPJE files may contain JP2 header boxes.

4.5.19 Marker Use and Order

For specific discussions and guidance related to allowed marker segments and their ordering within the LPJE codestream consult Appendix G of BPJ2K01.10.

## 4.6 Encode SPJE Constrained Codestreams (Not Approved)

SPJE - STANAG 7023 Preferred JPEG 2000 Encoding) defines the preferred JPEG 2000 compression encoding for STANAG 7023, NATO's Air Reconnaissance Primary Imagery Data Standard. SPJE is not approved for NSIF files at this time.

## 4.7 Decode JPEG 2000 Part 1 Profile-1 (Codestream)

An IUT must correctly decode any valid JPEG 2000 ISO 15444 Part-1, Profile-1, codestream to the limit of its available resources, and CLEVEL constraints. In many cases CLEVEL limitations will be met long before the decoding limits of JPEG 2000 Profile-1 codestreams. This section describes the features and restrictions, of J2K Part-1, Profile-1 codestreams that an IUT must be able to ingest and decode. Since Profile-0 is a subset of Profile-1 the implementation must also be capable of passing compliance tests for Profile-0.

### 4.7.1 9-7I Filtering.

IUT decodes J2K codestreams created with 9-7 irreversible filtering.

### 4.7.2 5-3R Filtering.

IUT decodes J2K codestreams created with 5-3 reversible filtering.

### 4.7.3 Progression Order.

IUT decodes J2K codestreams created with each of the following progression orders: LRCP, RLCP, RPCL, PCRL, and CPRL.

### 4.7.4 Wavelet Decomposition.

IUT decodes J2K codestreams created with 32 decomposition levels.

### 4.7.5 Quality Layers.

IUT decodes J2K codestreams created with 65535 quality layers.

### 4.7.6 Image/Grid Size.

IUT decodes J2K codestreams created with reference grid sizes from 1x1 to $(2^{31}-1)$ x $(2^{31}-1)$.

### 4.7.7 Tile Size.

IUT decodes J2K codestreams created with tile sizes from 1x1 to $(2^{31}-1)$ x $(2^{31}-1)$.

4.7.8 Precinct Size.

IUT decodes J2K codestreams created with precinct exponent values from 0 to 15. (0x0 ≤ PPx ≤ 0xF, 0x0 ≤ PPy ≤ 0xF.)

4.7.9 Empty Tiles.

IUT decodes J2K codestreams containing empty tiles.

4.7.10 Missing Tiles.

IUT decodes J2K codestreams in which packets for entire tiles are missing.

4.7.11 Components.

IUT decodes J2K codestreams containing up to 16384 components.

4.7.12 1 - 32 Bit Precision.

IUT decodes J2K codestreams containing from 1 to 32 bit precision encoded data.

4.7.17 Image Origin.

IUT decodes J2K codestreams created with image offset from origin values from 0 to $(2^{31}-2)$.

4.7.18 Tile Origin.

IUT decodes J2K codestreams with tile offset from origin value from 0 to $(2^{31}-2)$.

4.7.19 Codeblock Size.

IUT decodes J2K codestreams with codeblock height or width exponent offset values from 2 to 6. (Codeblock exponent offset are further restricted so that xcb + ycb <=12).

4.7.20 COC Marker.

IUT decodes J2K codestreams containing COC marker (0xFF53) segments.

4.7.21 RGN Marker.

IUT decodes J2K codestreams containing Region of Interest marker (0xF5E) segments.

4.7.22 QCD Marker.

IUT decodes J2K codestreams containing Quantization Default marker (0xF5C) segments.

4.7.23 QCC Marker.

IUT decodes J2K codestreams containing QCC marker (0xFF5D) segments.

#### 4.7.24 POC Marker.

IUT decodes J2K codestreams containing POC marker (0xFF5F) segments.

#### 4.7.25 TLM Marker.

IUT decodes J2K codestreams containing TLM marker (0xFF55) segments.

#### 4.7.26 PLM Marker.

IUT decodes J2K codestreams containing PLM marker (0xFF57) segments.

#### 4.7.27 PLT Marker.

IUT decodes J2K codestreams containing PLT marker (0xFF58) segments.

#### 4.7.28 PPM Marker.

IUT decodes J2K codestreams containing PPM marker (0xFF60) segments.

#### 4.7.29 PPT Marker.

IUT decodes J2K codestreams containing PPT marker (0xFF61) segments.

#### 4.7.30 SOP Marker.

IUT decodes J2K codestreams containing SOP marker (0xFF91) segments.

#### 4.7.31 EPH Marker.

IUT decodes J2K codestreams containing EPH marker (0xFF92) segments.

#### 4.7.32 CRG Marker.

IUT decodes J2K codestreams containing CRG marker (0xFF63) segments.

#### 4.7.33 COM Marker.

IUT decodes J2K codestreams containing COM marker (0xFF64) segments.

#### 4.7.34 Marker Precedence

IUT decodes J2K codestreams giving precedence to markers in the tile header versus the JPEG main header.

#### 4.7.35 Decoder Cclass Guarantee.

IUT has sufficient resources to accurately decode J2K codestreams according to the IUT's compliance class (Cclass), J2K codestream's Profile and IUT's Clevel. Table C-A-2 summarizes the J2K Cclass that an IUT must fully decode given the CLEVEL support requirement of the IUT. The definitions of J2K Cclasses parameters are described in ISO/IEC 15444-4:2002 Information Technology - JPEG 2000 Image coding system – Part 4, Annex A. Table C-A-2 provides NITF/NSIF file CLEVEL compliance ranges as well as their mapping to JPEG 2000 Cclasses.

4.7.35.1 Cclass 1 Profile-0

IUT accurately decodes the Profile-0 ISO test codestreams, to within the allowable error levels for Cclass 1 implementations defined in ISO/IEC 15444-4:2002 Annex B.

4.7.35.2 Cclass 1 Profile-1

IUT accurately decodes the Profile-1 ISO test codestreams, to within the allowable error levels for Cclass 1 implementations defined in ISO/IEC 15444-4:2002 Annex B.

**Figure D-2. Cclass vs NITFS/BIIF/NSIF (NBN) System Complexity Levels**

| IUT Support Requirement | IUT Complexity Level Support Requirement | | | | |
|---|---|---|---|---|---|
| J2K Cclasses | **3** | **5** | **6** | **7** | **9** |
| **0** | S | S | S | S | O |
| **1** | S | S | S | S | O |
| **2** | P[1] | P[2] | P[3] | P[3] | O |

S = Guaranteed resources to fully decode the J2K ISO subcommittee's test codestreams.
P = Resources to partially decode, or quit while decoding J2K codestream.
O = Optional
Note 1: IUT guarantees resources for all Cclass parameters, except Size, Components, $N_{cb}$, and $N_{comp}$.
Note 2: IUT guarantees resources for all Cclass parameters, except Size, $N_{cb}$, and $N_{comp}$.
Note 3: IUT guarantees resources for all Cclass parameters, except $N_{cb}$, and $N_{comp}$.

(Note: As CLEVEL 9 defines, NBN files out of specification with other CLEVELs and there are no mandated supported requirements for decoders. Hence, there is no way to know which out of bounds requirement a CLEVEL 9 capable decode may support.)

4.7.36 Quit Decoding.

IUT quits decoding J2K codestreams that exceed the Cclass decoder limitations described in ISO/IEC 15444-4:2002 Part 4, Annex A without adversely affecting the operation of the IUT. An IUT need not decode, or may quit decoding a J2K codestream once that codestream exceeds the Cclass decorder guarantees.

4.7.37 Reduced Resolution.

IUT decodes J2K codestreams to any user-selected resolution encoded within the J2K codestream.

4.7.38 Reduced Component.

IUT decodes any user-selected component encoded within the J2K codestream.

4.7.39 Reduced Quality.

IUT decodes J2K codestreams to any user-selected quality layer encoded within the J2K codestream.

4.7.40 Reduced Tile.

IUT decodes any user-selected tile encoded within the J2K codestream.

4.7.41 Display NBN J2K.

When displaying imagery decoded from NBN J2K files, IUT displays the image data according to guidelines for displaying NBN images, ie attention to Display and Attachment levels, IREPBAND, NROWS, NCOLS and ILOC values.

4.7.42 Truncated File.

IUT decodes available image data from a J2K codestream that has been truncated.

4.7.43 Truncated File Warning.

IUT alerts users that compressed file is truncated or incomplete with respect to the JPEG 2000 header and format information.

4.7.44 NSIF Data Length Precedence

For all JPEG 2000 formats, the information within the JPEG 2000 codestream portions of the bitstream is given precedence, with the exception of information about the length of the compressed image in the NSIF format (BPJ2K01.10, Section 8.1).

4.8 Repack JPEG 2000 Codestream

This section describes possible deltas in repackaged J2K codestreams. The J2K codestreams produced by an IUT that chooses to repackage or modify an existing J2K codestream must demonstrate the following requirements. For most of the criteria listed in this section, the repackaging shall not be done by decoding the JPEG codestream packets and re-encoding the data or by labeling packets as not being present in the codestream. But rather, J2K packets from the original codestream will be rearranged and/or removed to form the desired J2K codestream. Implementations must be able to modify or create new marker segments and header information to describe the repackaged codestream. The IUT may use an automated process in order to repackage the codestream, or allow the user to make specific choices in repackaging the compressed data. e.g. IUT automatically drops quality layers of tiles that do not contain pixel values exhibiting a certain contrast level across the tile, or IUT discards tiles not specifically selected by the operator via the user interface or a feature recognition algorithm.

4.8.1 Positional Subset (Chipping).

IUT repackages J2K codestreams with a subset of the pixels contained in an original JPEG 2000 test codestream.

4.8.1.1 On Tile Boundaries

IUT repackages J2K codestreams using a subset of the whole tiles contained in an original JPEG 2000 test codestream.

4.8.1.2 Off Tile Boundaries

IUT repackages J2K codestreams using a subset of the whole or partial tiles contained in an original JPEG 2000 test codestream. (IUT will have to recode tiles that have lost some of their original pixels).

4.8.1.3 On Codeblock Boundaries

IUT repackages J2K codestreams using a subset of the whole codeblocks contained in an original JPEG 2000 test codestream.

4.8.2 Empty Tiles.

IUT repackages J2K codestreams with more empty tiles when compared to the image encoded in the original JPEG 2000 test codestream.

4.8.3 Reduced Resolution.

IUT repackages J2K codestream with a reduced resolution when compared to the image encoded in the original JPEG 2000 test codestream.

4.8.4 Reduced Number of Components.

IUT repackages J2K codestream with fewer components than the image encoded in the original JPEG 2000 test codestream.

4.8.5 Reduced Number of Layers.

IUT repackages J2K codestream with fewer quality layers than the image encoded in the original JPEG 2000 test codestream.

4.8.6 Region of Interest.

IUT repackages J2K codestream with regions encoded with lower quality than the same region in the original JPEG 2000 test codestream. (e.g. On tile or precinct boundaries.)

4.8.7 Progression Order.

IUT repackages existing J2K codestream with a different progression order, chipping (selected tiles), reduced quality (less layers) or fewer resolutions than the image encoded in the original JPEG 2000 codestream.

4.8.8 Repackage NBN J2K to NBN J2K files.

IUT repacks an existing NBN J2K 2000 Part 1 Profile-1 files into another NBN J2K file.

4.8.9 Repackage NBN J2K to NPJE, EPJE and TPJE NBN files.

IUT repacks an existing NBN J2K 2000 Part 1 Profile-1 files into an NPJE, EPJE or TPJE constrained NBN file.

4.8.10 Header Correction

IUT updates header information to reflect newly repackaged J2K codestream.

4.8.10.1 JPEG 2000 Markers

IUT updates J2K header information to reflect newly repackaged J2K codestream.

4.8.10.2 NSIF Header

IUT updates NSIF image subheader information to reflect newly repackaged J2K codestream.

4.8.10.3 J2KLRA

If present in source product, the IUT updates J2KLRA fields to reflect newly repackaged J2K codestream.

4.8.11 Parameter Broadening.

When a JPEG 2000 codestream is created via repackaging, a few of the parameters shown in Tables for Appendixes, D (NPJE), E (EPJE) and F (TPJE) within BPJ2K01.10 have a wider range than the values shown for source image encoding. The parameters where this value broadening are allowed are Xsiz, Ysiz, XOsiz, YOsiz, XRsiz, YRsiz, Ltlm, Ztlm, $N_{Levels}$, and $N_{Layers}$. See Appendix A, of BPJ2K01.10 for more information on how specific repackaging operations modify these values.

4.9 Decode JPG file header boxes

IUT accurately decodes NBN JP2 files containing header boxes as follows:

- The IUT decodes and displays the first compressed image from a JP2 formatted file containing more than one image
- The IUT accurately decodes supported JP2 boxes contained within a JP2 files, the IUT's decoding accuracy is determined by decoding the ISO reference JP2 test files
- The IUT skips by or ignores, without adverse effect, any JP2 boxes that it does not understand
- The IUT as a minimum unparsed and process the codestream

4.10 NBN File Structure

The following paragraphs describe constraints and requirements for selected fields of NBN J2K files created by an IUT. NBN Image Subheader. Key fields in the image subheader are used to describe, and are functions of, values found in the associated JPEG 2000 codestream. This section describes those fields.

4.10.1 NROWS NCOLS.

NROWS = $\lceil Ysiz / IMAG\_New) \rceil$ - $\lceil YOsiz / IMAG\_New) \rceil$, NCOLS = $\lceil Xsiz / IMAG\_New) \rceil$ - $\lceil XOsiz / IMAG\_New) \rceil$. These fields reflect the maximal image samples in the row and column dimension over all image components of JPEG 2000 codestream.

4.10.2 PVTYPE.

The PVTYPE field contains a value determind by examination of values of Ssiz for all $i$ components of the JPEG 2000 codestream. PVTYPE = B for $\max_i(Ssiz^i) = 0$, PVTYPE = INT for $\max_i(Ssiz^i) \in [1, 31]$, PVTYPE = SI for $\max_i(Ssiz^i) \in [128,159]$.

4.10.3 IREP.

IREP field contains the value appropriate for uncompressed image represented by the JPEG 2000 codestream.

4.10.4 ABPP.

The ABPP value is equal to the NBPP field value.

4.10.5 NBPP.

NBPP = $\max_i(\text{Ssiz}^i$ & 0x7F)+1. This field reflects the maximum component bitdepth over all *i* components in the JPEG 2000 codestream.

4.10.6 IC.

Image Compression code is set to C8 or M8.

4.10.7 COMRAT.

4.10.7.1Rate.

Compression rate field is set to the approximate number of bits-per-pixel-per-band for the compressed image.

4.10.7.2 Type N.

This field also includes the N prefix to signal numerically lossless content and in the format of Nxyz, where “xyz” indicates the expected achieved bitrate, the decimal point is implicit and a single digit of form “nn.n” for “xyz”. (Note: >28 bits per component imagery, generally, cannot be encoded numerically lossless.)

4.10.7.3 Type V.

This field also includes the V prefix to signal visually lossless content and in the format of Vxyz, where “xyz” indicates the expected achieved bitrate, the decimal point is implicit and a single digit of form “nn.n” for “xyz”.

4.10.7.4 Type w.

This field will not have a prefix, thus signaling lossy compression, when the associated JPEG codestream indicates irreversible encoding or a compressed target bit rate # 3.5bpp and in the format of wxyz, where “wxyz” indicates the expected achieved bitrate, the decimal point is implicit and a single digit of form “nnn.n” for “wxyz”.

4.10.8 NBANDS XBANDS.

These fields contain a value equal to the Csiz value in the Image and tile size marker of the associated J2K codestream. The value indicates the number of components in the J2K codestreams.

4.10.9 IMODE.

This field is set to the value “B”, indicating band interleaved by block.

4.10.10 NBPR NBPC.

NBPR = $\lceil (Xsiz - XTO)/XTsiz \rceil$, NBPC = $\lceil (Ysiz - YTO)/YTsiz \rceil$. These fields contain a value determined by examination of values for tiling geometry in the image and size marker of the JPEG 2000 codestream.

4.10.11 NPPBH NPPBV.

NPPBH = $\lfloor XTsiz/(\min_i(XRsiz^i)) \rfloor$, NPPBV = $\lfloor YTsiz/(\min_i(YRsiz^i)) \rfloor$. These fields contain a value determined by examination of values for tiling geometry and subsampling of all *i* components in the image and size marker of the JPEG 2000 codestream.

4.10.12 IMAG.

This field contains the approximate image magnification (or reduction) factor of the compressed image data relative to the original source image and be consisted with JPEG 2000 compressed image data segment and associated parameters in the Image and Tile Size (SIZ) Marker Segment fields and codestream.

4.11 J2KLRA TRE

The J2KLRA tagged record extension shall be included with any imagery that is compressed following the EPJE BPJ2K01.10 Appendix E or TPJE BPJ2K01.10 Appendix D and is recommend for NPJE BPJ2K01.10 Section 8.3. The structure of the J2KLRA can be found in BPJ2K01.10 Section 8.3. This section lists requirements for key fields of the J2KLRA TRE.

4.11.1 Original TRE.

All TRE fields, except the conditional Nxxxx_I fields, are populated. At the original or primary compression of image data, the included J2KLRA summarizes the original compression. The subsequent conditional fields are not present.

4.11.2 ORIG.

ORIG field indicates the origin or condition of the compressed image data, according to the operator selections in the user interface or system defaults.

4.11.3 NLEVELS_O.

NLEVELS_O field value equals the number of wavelet decomposition levels performed during the original image compression. For the original J2K codestream wrapped in the NBN file format, the NLEVELS_O value shall be equal to the $N_{levels}$ value found in the coding style default marker segment. In a derived or repackaged J2K compressed product the NLEVELS_O value may or may not be equal to the included $N_{levels}$ value but must remain equal to original $N_{levels}$ value.

4.11.4 NBANDS_O.

NBANDS_O field value equals the number of components in the original image compression. For the original J2K codestream wrapped in a the NBN file format, the NBANDS_O value shall be equal to the Csiz value found in the image and tile size marker segment. In a derived or repackaged J2K compressed product the NBANDS_O value may or may not be equal to the included Csiz value but must remain equal to original Csiz value.

#### 4.11.5 NLAYERS_O.

NLAYERS_O field value equals the number of quality layers in the original image compression. For the original J2K codestream wrapped in a the NBN file format, the NLAYERS_O value shall be equal to the $N_{layers}$ value found in the coding style default marker segment In a derived or repackaged J2K compressed product the NLAYERS_O value may or may not be equal to the included $N_{layers}$ value but must remain equal to original $N_{layers}$ value.

#### 4.11.6 LAYER_$ID_n$.

LAYER_$ID_n$ field repeats for each quality layer in the original J2K compressed codestream. LAYER_$ID_n$ field value starts at zero and increases by one for each LAYER_IDn field.

#### 4.11.7 $BITRATE_n$.

$BITRATE_n$ field repeats for each quality layer in the original J2K compressed codestream. $BITRATE_n$ field value is approximately equal to the compressed bit rate of layer n of the original J2K codestream.

#### 4.11.8 Repackaged TRE.

ORIG field = “1”, “3”, “5” or “9”. In a repackaged or derived J2K compressed NBN J2K file, all TRE fields are present to include the conditional Nxxxx_I fields.

#### 4.11.9 NLEVELS_I.

NLEVELS_I = $N_{levels}$. The NLEVELS_I field value is equal to the number of wavlet decompositions in the associated J2K codestream.

#### 4.11.10 NLAYERS_I.

NLAYERS_I = $N_{layers}$. The NLAYERS_I field value is equal to the number of quality layers in the associated J2K codestream.

#### 4.11.11 NBANDS_I.

NBANDS_I = Csiz. The NBANDS_I field value is equal to the number of components in the associated J2K codestream.

### 4.12 CLEVEL Ranges

The following paragraphs describe CLEVEL constraints and test criteria for NBN J2K files and systems (see Table C-A-3). An NBN system is expected to be able to correctly decode any JPEG 2000 Part 1 Profile-1 codestream within the bounds of its supported complexity levels. Table C-A-2 provides NITFS/NSIF file CLEVEL compliance ranges as well as mapping to JPEG 2000 compliance classes (Cclass).

4.12.1 CLEVEL Marking.

IUT marks NBN J2K files at the lowest CLEVEL for which they qualify.

4.12.2 Interpret CLEVEL.

IUT can interpret NBN J2K files at the CLEVEL and all lower CLEVELs, for which compliance is sought.

4.12.3 Generate CLEVEL.

IUT can generate NBN J2K files at the CLEVEL and all lower CLEVELs, for which compliance is sought. (NOTE: May not apply to systems developed for specific limited functions. e.g. systems designed to only J2K compress large (> 8k x 8k) image arrays into NBN files.)

4.12.4 CLEVEL Components.

IUT decodes J2K codestreams containing up to the maximum number of allowed components for the NBN CLEVEL for which compliance is sought. (See the Complexity Level Table D-1 in ISO/IEC BIIF Profile NSIF 01.01 for component limits for each CLEVEL)

# ANNEX E NSIF Approved Support Data Extension Listing

1. General Information

1.1 This Annex provides general information on the approved Support Data Extensions (SDEs) to be used with the NATO Secondary Imagery Format (NSIF). Support Data Extensions can be either in the form of Tagged Record Extensions (TREs, also known as “TAGs”) which modify the primary segments, or as Data Extension Segments (DESs) which allow additional data beyond that supported by the primary segment types (image, graphics, text) to be incorporated into an NSIF file.

IMPORTANT NOTE: This Annex specifies the current version of each TRE at the time of writing. The most current version of each TRE in is maintained on the NATO web page (see http://www.nato.int/structur/AC/224/standard/4545/NSIF_Approved_SDEs.htm; STANAG 4545 information includes the current published STANAG, updated errata sheets, the current registry of extensions, and the registry of approved applications). Users who are planning to use this information should check the web page to verify that the most current information is used and to get the details of each SDE.

1.2 Extensions can be developed and included in this list by applying to the Custodian. The Custodian will present the proposed extension to the 4545 CST for review and approval. Changes to the approved extensions list will be handled in the same manner as changes to standard (see the STANAG 4545 Configuration Management Plan in ANNEX F of this document).

1.3 SDEs are identified by tags. The DESs use a long descriptive name (DES ID) of up to 25 characters. TREs are identified by a six-character identifier. The six characters are as follows:

- A 5-character (or less) alphanumeric (BCS-A) identifier for the SDE ;
- a 1-character alphanumeric (BCS-A) identifier defining the SDE version number (“A”, “B”, …)

1.4 There are two categories of extensions, registered and controlled. Registered tags have the name reserved but the contents of the tag are not under configuration control. This is typically because the tag is still in development. Controlled tags are for those extensions that have been placed under formal configuration management. Only controlled tags are included in this approved list.

1.5 There are three groups of SDEs that are frequently used together, plus miscellaneous extensions that have specific applications. The extensions associated with the groups can, in many cases, be used separately as well. The three groups are the Geospatial SDEs, the Airborne SDEs, and the Commercial SDEs.

1.6 In the following discussion deprecated TREs and DESs are marked. In all cases deprecated items are being discontinued and should only be read for legacy purposes. They should not be generated in new systems. If a deprecated item is required the requirement organization should provide justification.

2. Geospatial SDEs

2.1 Image and raster map providers produce NSIF Files with support data from other formats which contain support information. The table below identifies the controlled extensions that define the format for the support information required within a NSIF File that contains geo-referenced image, matrix, or raster map data. These extensions, also called the Geospatial Support Data Extensions (GeoSDEs), are defined in DIGEST - Part 2, Annex D. Annex D appeared in version 2.0 of DIGEST. This initial version of the GeoSDEs is identified as version “A”. Most of the current versions are “B”, with one “C”.
Use of the latest version of the GeoSDEs is highly recommended. See the DIGEST home page
http://www.digest.org
and the STANAG 4545 SDE registry
http://www.nato.int/structur/AC/224/standard/4545/NSIF_Approved_SDEs.htm
for details.

2.2 The GeoSDEs are the TREs relevant to geo-referenced image, matrix, or raster map data. Systems using geo-referenced imagery, matrix, or raster map data formatted according to NSIF should be designed to extract the needed data from the TRE described in DIGEST. The categories of image and extensive digital geographic information are shown in DIGEST. The minimum set of spatial data extensions required for spatial location is composed as follows. The GEOPS extension is required and shall be associated with one of the GEOLO, MAPLO, GRDPS or REGPT extensions. The PRJPS extension is required when the absolute coordinate system is a cartographic coordinate system. This minimum set of extensions is required for compliance with DIGEST. The BNDPL extension is optional and is not required for compliance with DIGEST.

**Table E-1. Geospatial Support Data Extensions (GEOSDE)**

| *SDE IDENTIFIER* | *SCOPE* |
|---|---|
| ACCHZB | Horizontal Accuracy |
| ACCPOB | Positional Accuracy |
| ACCVTB | Vertical Accuracy |
| ATTPTA | Attribute points |
| BNDPLB | Accurate geographic location of the significant part of the image |
| FACCBB | Attribute FACC Code definition |
| GEOLOB | Image, raster, or matrix data rectified consistently with geographic (lat/long) coordinate systems |
| GEOPSB | Geo-referencing parameters including datum and ellipsoids |
| GRDPSB | Non-rectified image, raster, or matrix data that is positioned using a location grid |
| MAPLOB | Image, raster, or matrix data rectified consistently with cartographic (E,N) coordinate systems |
| PRJPSB | Projection parameters |
| REGPTB,REGPTC | Registration points in either geographic or cartographic systems (version B or C) |
| SNSPSB | Sensor Parameters Data Extension |
| SOURCB | Map Source Description |

§ - Deprecated

3. Airborne SDEs

3.1 The Airborne SDEs are designed to provide for the transmission of sensor and platform data required to properly exploit airborne sensor systems. There are eighteen selectable SDEs, the choice of which depends on the requirements of the particular system. Some, for example, are specifically intended for synthetic aperture radar systems. Others are for electro-optical sensors. The following table defines the airborne SDEs. The last four columns show which are required (R), optional (O), or not applicable(N) for each sensor type.

**Table E-2. Airborne Support Data Extensions (ASDEs)**

| *Tag* | *Title* | *SAR* | *EO* | *IR* | *MSI/HSI* |
|---|---|---|---|---|---|
| ACFTB | Aircraft Information (ACFTA§) | R | R | R | R |
| AIMIDB | Additional Image ID (AIMIDA§) | R | R | R | R |
| BANDSB | MSI/HSI Parameters (BANDSA§) | N | O | O | R |
| BLOCKA | Image Block Information | O | O | O | O |
| CMETAA§ | Complex SAR Data (Replaced by SICD & SIDD) | O | N | N | N |
| EXOPTA | Exploitation Usability | N | O | O | O |
| EXPLTB | Exploitation Related (EXPLTA§) | O | N | N | N |
| HISTOA | Softcopy History | O | O | O | O |
| ICHIPB | Image Chip Information | O | O | O | O |
| MENSRB | SAR Mensuration (MENSRA§) | O | N | N | N |
| MPDSRA§ | EO/IR Mensuration (No replacement at this time) | N | O | O | O |
| MSTGTA | Mission Target | O | O | O | O |
| PATCHB | Patch Information (PATCHA§) | O | N | N | N |
| PIAPRB/C | Image Access Product | O | O | O | O |
| RPC00B | Rapid Positioning Data | N | O | O | O |
| SECTGA | Secondary Targeting | O | O | O | O |
| SENSRB | Sensor Parameters | N | R | R | R |
| STREOB | Stereo Image Information | N | O | O | O |
| ASTORA | ASTOR Program Radar Data Extension | | | | |
| Key: R – Required; O – Optional; N – Not Applicable | | | | | |

§ - Deprecated

4. Technical Notes for Airborne SDEs:

4.1 Geospatial Coordinates

4.1.1 Figure D-1 shows the earth coordinate frame, the local North-East-Down (NED) coordinate frame, and the platform location parameters: latitude and longitude. The platform location parameters define the location in earth coordinates of the sensor platform, or more specifically, the platform center of navigation. The center of navigation is the origin of the local NED coordinate frame; its location within the platform is defined uniquely for each platform and sensor. The local NED coordinates are North (N), East (E), and Down (D) as shown.

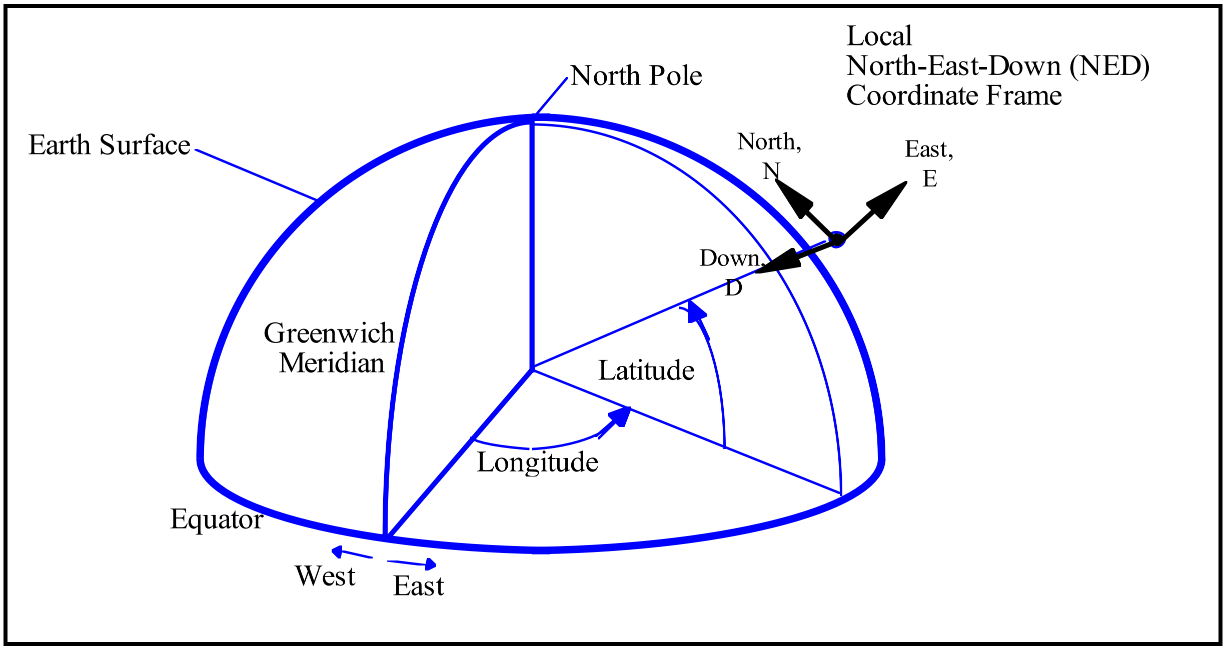



**Figure E-1. Platform Location Coordinates**

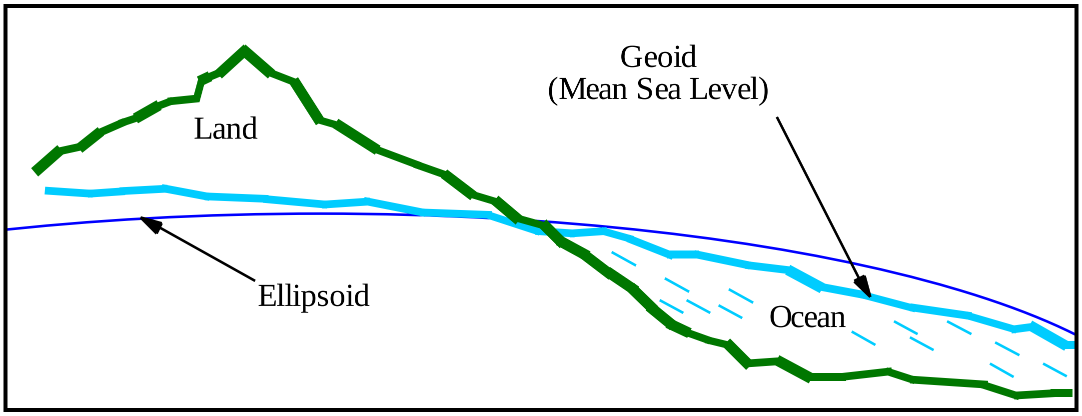



**Figure E-2. Ellipsoid and Geoid Models of the Earth's Surface**

4.1.2 The earth surface in Figure D-1 is described in the World Geodetic System of 1984 (WGS-84) as two different model surfaces. The two surfaces are an ellipsoid and a geoid (see Figure D-2). The ellipsoid is an ideal mathematical surface; the geoid is the mean-sea-level surface of the earth as determined by gravitational potential (elevation of the geoid relative to the ellipsoid varies with location from -102 to +74 meters). Platform latitude and longitude are referenced to the ellipsoid, while platform altitude mean sea level (MSL) is defined with respect to the geoid. Altitude MSL is the vertical distance from mean sea level to the platform. The Global Positioning System is referenced to the ellipsoid.

4.1.3 The Down-axis (D) of the NED coordinate frame lies normal to the geoid. That is, D lies in the direction of gravitational acceleration. The North-axis (N) and East-axis (E) lie in the geometric plane perpendicular to D (the horizontal plane), with N in the direction of True North.

4.2 Attitude Parameters: Heading, Pitch, and Roll

4.2.1 Heading, pitch, and roll relate the platform body coordinate frame to the local NED frame. Figure D-3 shows the platform body coordinates. $X_a$ is positive forward, along the roll axis. $Y_a$ is positive right, along the pitch axis. $Z_a$ is positive down, along the yaw axis. The platform body frame, like the local NED frame, has its origin at the center of navigation.

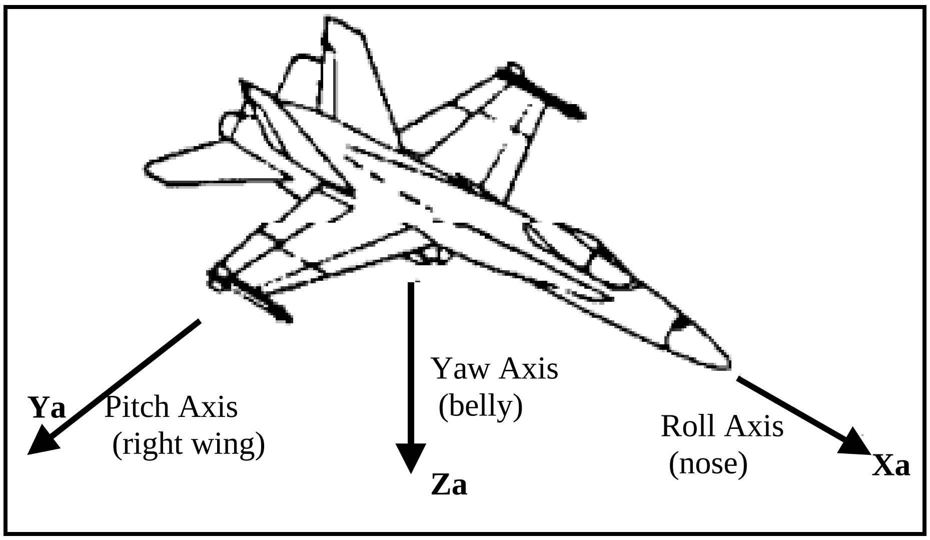



**Figure E-3. Platform Body Coordinate Frame**

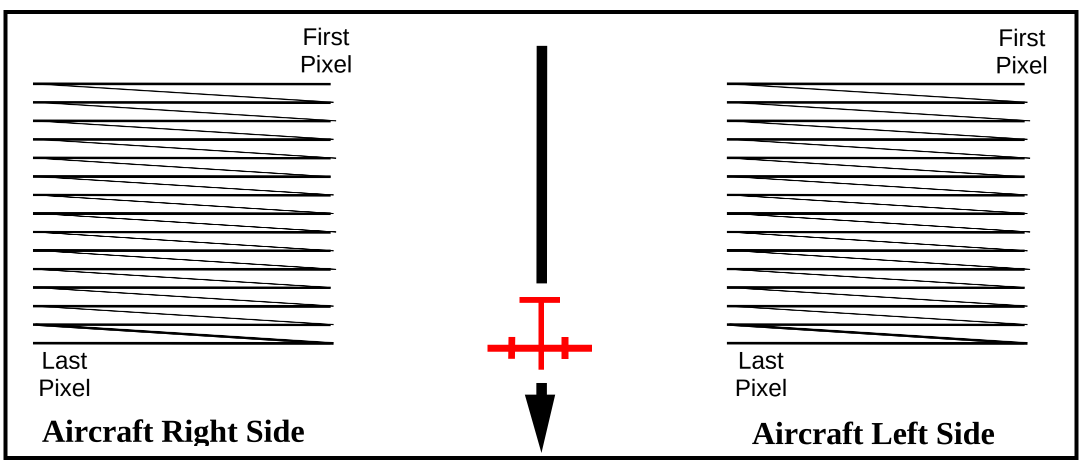



**Figure E-4. Historic SAR Scanning Patterns**

4.2.2 Heading is the angle from north to the NED horizontal projection of the platform positive roll axis, $X_a$ (positive from north to east). Pitch is the angle from the NED horizontal plane to the platform positive roll axis, $X_a$ (positive when $X_a$ is above the NED horizontal plane), and is limited to values between ±90 degrees. Roll is the rotation angle about the platform roll axis. Roll is positive if the platform positive pitch axis; $Y_a$ (right wing) lies below the NED horizontal plane.

## 4.3 NSIF Pixel Ordering

4.3.1 The NSIF coordinate system is a left to right, top to bottom, coordinate system. Column numbers increase to the right, and row numbers increase downwards. The first pixel within a block is at the upper left, with subsequent pixels to the right along the row, until the last pixel of a row is followed by the left-most pixel of the next lower row. See Figure D-5.

4.3.2 Care must be taken to generate imagery with pixels ordered as specified by NSIF. A historic coordinate system for some SAR systems is left to right, bottom up, with scan lines oriented in the direction of the radar beam (cross-track) and pixel locations representing distance (range).

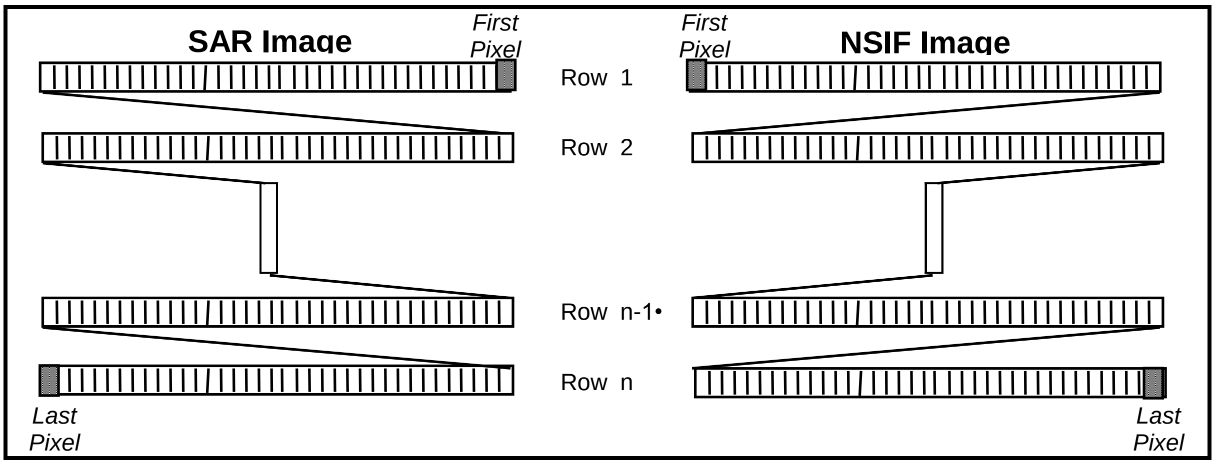



**Figure E-5. Historic SAR Collection Relationship with the NSIF Coordinate System**

4.3.3 When mapping on the right side of the aircraft, the first pixel of each scan line is at minimum range with subsequent pixels at increasing range; when mapping on the left side, the first pixel of each scan line is at maximum range with subsequent pixels at decreasing range. See Figure D-4. Imagery from these, and other similar systems, will display *mirrored* on an NSIF screen unless the pixels are reordered to be consistent with the NSIF standard. Although this discussion specifically addresses some known SAR systems, similar care must be taken with EO/IR imagery to ensure correct pixel ordering within NSIF files.

## 4.4 Rational Projection Model (RPC)

4.4.1 The geometric sensor model describing the precise relationship between image coordinates and ground coordinates is known as a Rigorous Projection Model. A Rigorous Projection Model expresses the mapping of the image space coordinates of rows and columns (r,c) onto the object space reference surface geodetic coordinates ( $\varphi, \lambda, h$ ).

4.4.2 RPC00 supports a common approximation to the Rigorous Projection Models. The approximation used by RPC00 is a set of rational polynomials expressing the normalized row and column values, ($r_n, c_n$), as a function of normalized geodetic latitude, longitude, and height, ($P, L, H$), given a set of normalized polynomial coefficients (LINE_NUM_COEF_n, LINE_DEN_COEF_n, SAMP_NUM_COEF_n, SAMP_DEN_COEF_n). Normalized values, rather than actual values are used in order to minimize introduction of errors during the calculations. The transformation between row and column values (r, c), and normalized row and column values ($r_n, c_n$), and between the geodetic latitude, longitude, and height ($\varphi, \lambda, h$), and normalized geodetic latitude, longitude, and height ($P, L, H$), is defined by a set of normalizing translations (offsets) and scales that ensure all values are contained in the range -1 to +1.

P = (Latitude - LAT_OFF) ÷ LAT_SCALE
L = (Longitude - LONG_OFF) ÷ LONG_SCALE
H = (Height - HEIGHT_OFF) ÷ HEIGHT_SCALE
$r_n$ = (Row - LINE_OFF) ÷ LINE_SCALE
$c_n$ = (Column - SAMP_OFF) ÷ SAMP_SCALE

4.4.3 The rational function polynomial equations are defined as:

$$r_n = \frac{\sum_{i=1}^{20} \mathrm{LINE\_NUM\_COEF}_i \cdot \rho_i(P,L,H)}{\sum_{i=1}^{20} \mathrm{LINE\_DEN\_COEF}_i \cdot \rho_i(P,L,H)} \quad \text{and} \quad c_n = \frac{\sum_{i=1}^{20} \mathrm{SAMP\_NUM\_COEF}_i \cdot \rho_i(P,L,H)}{\sum_{i=1}^{20} \mathrm{SAMP\_DEN\_COEF}_i \cdot \rho_i(P,L,H)}$$

4.4.4 The rational function polynomial equation numerators and denominators each are 20-term cubic polynomial functions of the form:

$$\sum_{i=1}^{20} C_i \cdot \rho_i(P, L, H) = \begin{pmatrix} C_1 & +C_6 \cdot L \cdot H & +C_{11} \cdot P \cdot L \cdot H & +C_{16} \cdot P^3 \\ +C_2 \cdot L & +C_7 \cdot P \cdot H & +C_{12} \cdot L^3 & +C_{17} \cdot P \cdot H^2 \\ +C_3 \cdot P & +C_8 \cdot L^2 & +C_{13} \cdot L \cdot P^2 & +C_{18} \cdot L^2 \cdot H \\ +C_4 \cdot H & +C_9 \cdot P^2 & +C_{14} \cdot L \cdot H^2 & +C_{19} \cdot P^2 \cdot H \\ +C_5 \cdot L \cdot P & +C_{10} \cdot H^2 & +C_{15} \cdot L^2 \cdot P & +C_{20} \cdot H^3 \end{pmatrix}$$

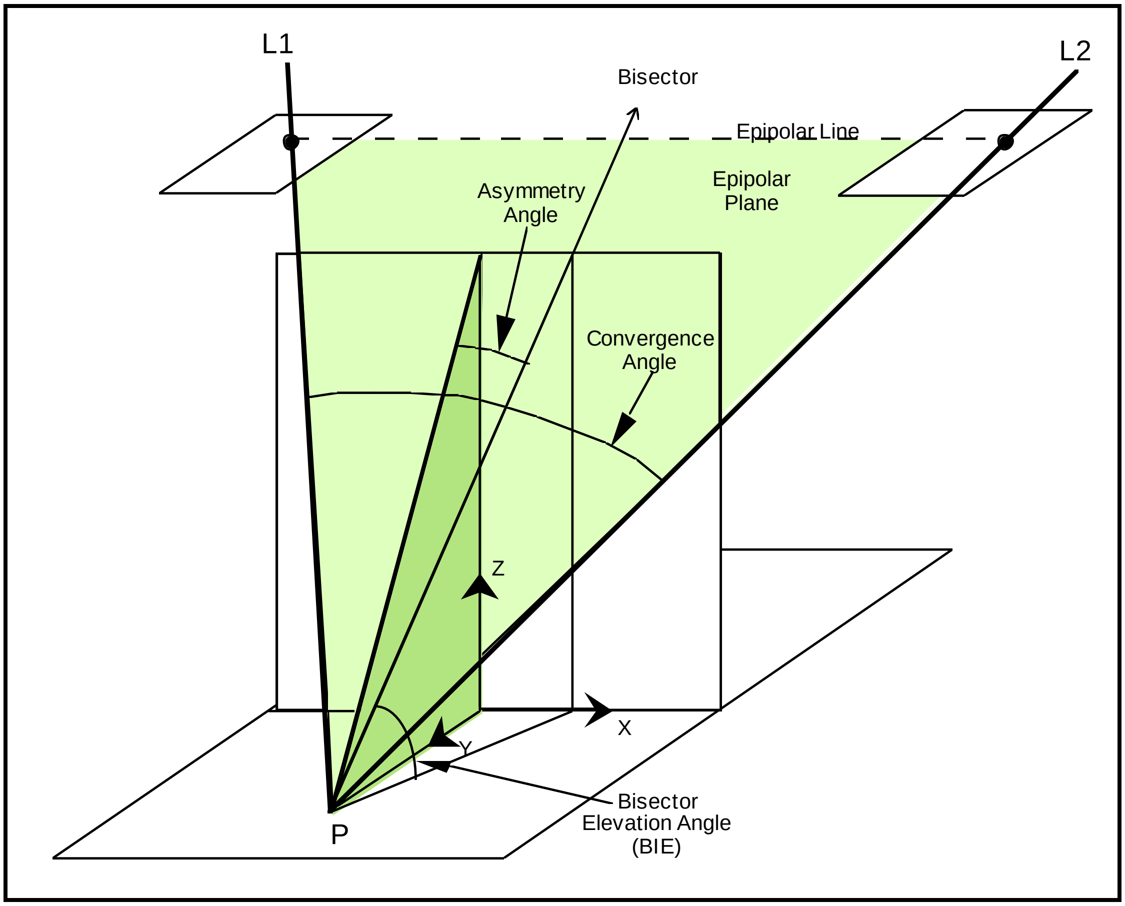



**Figure E-6. Asymmetry Angle, Convergence Angle and Bisector Elevation Angle**

where coefficients $C_1 \cdots C_{20}$ represent the following sets of coefficients:

$$\left( \begin{array}{c} \text{LINE\_NUM\_COEF\_n} \\ \text{LINE\_DEN\_COEF\_n} \\ \text{SAMP\_NUM\_COEF\_n} \\ \text{SAMP\_DEN\_COEF\_n} \end{array} \right)$$

4.4.5 The image coordinates are in units of pixels. The ground coordinates are latitude and longitude in units of decimal degrees and the geodetic elevation in units of meters. The ground coordinates are referenced to WGS-84.

4.4.6 For those users who must calculate the coefficients for their sensor, the equations are beyond the scope of this document. Users who must provide the coefficients are encouraged to reference standard photogrammetric models. An example reference is the *Manual of Photogrammetry – Fifth Edition*, American Society of Photogrammetry and Remote Sensing (ASPRS), Chapter 11, pages 887-948 (replacement sensor models), section 11.3.5 RSM Generation.

4.5 Stereo Projection Model

The two images comprising a Stereo Pair are referred to as the Left and Right images; the Beginning and Ending Asymmetry, Convergence, and Bisector Elevation angles define the geometry between the two images (Figure D-6). The Beginning and Ending angles are always measured from the first and last lines, respectively, of the Left image, but measurement locations in the Right image are dependent on the rotation required to align the imagery (Figure D-7). When the two images are collected in succession along a flight path, the fore (aft) image is the Left (Right) image.

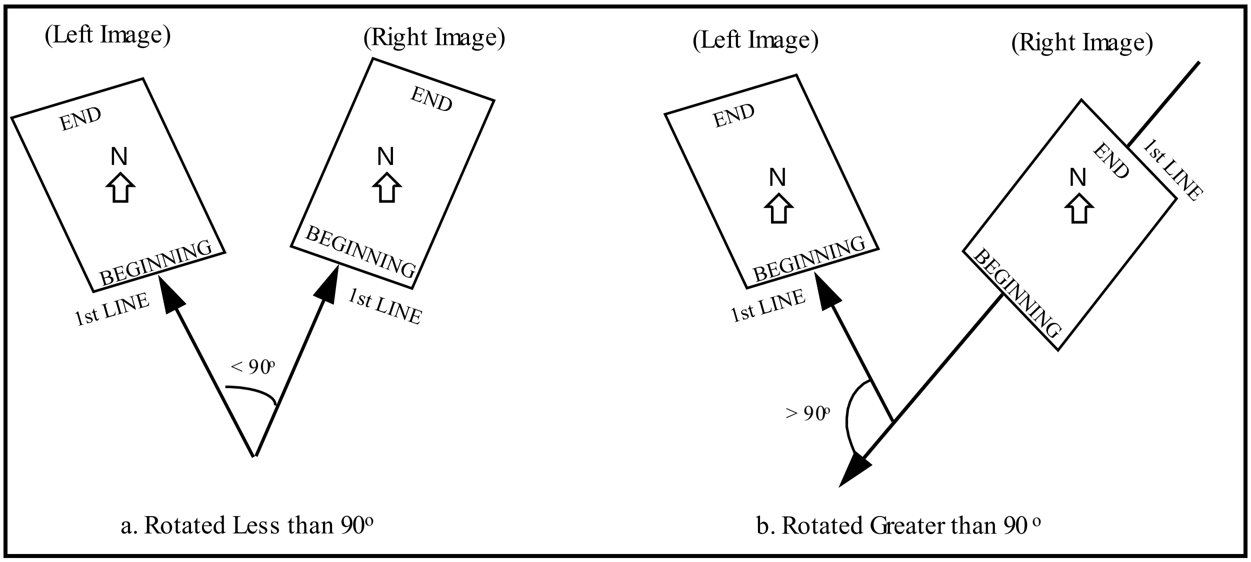



**Figure E-7. Location Of Beginning/Ending Angles**

4.6 Date Representations – Y2K Compliance

Several extensions contain non-standard date formats with the year represented by only two digits. In all fields containing two digit year representations, 00 through 59 indicate the years 2000 through 2059, and 60 through 99 indicate 1960 through 1999. As affected extensions evolve, the fields will be expanded to support standard date formats with four digits for the year.

4.7 Reduced Resolution Imagery

4.7.1 Large images are often processed into Reduced Resolution Data Sets (RRDS) to simplify and speed display and zooming functions. When a reduced resolution image is produced the associated mensuration data can be recalculated to be consistent with the new image, or the reduction can be flagged and the original data inserted without change into the new file. The latter approach is recommended as repeated recalculations to accommodate multiple resolution changes can result in degraded data.

4.7.2 Within NSIF files, the image subheader IMAG field indicates the relation between image pixel spacing and associated TRE data.

IMAG = 1.0 means the TRE data apply directly (1:1) to the image – the TRE data was recalculated if the file is a member of a RRDS.

IMAG ≠ 1.0 means the TRE data is not already scaled, and must be recalculated before use.

The following fields must be recalculated:

**Table E-3. Fields to Recalculate for Reduced Resolution Data Sets (RRDS)**

| SAR | | | EO | |
|---|---|---|---|---|
| TRE | Fields Altered | | TRE | Fields Altered |
| | | | | |
| ACFTB | ROW_SPACING | | ACFTB | ROW_SPACING |
| | COL_SPACING | | | COL_SPACING |
| | | | | |
| EXPLTB | N_SAMP | | EXOPTA | MAX_LP_SEG |
| | | | | MEAN_GSD |
| BLOCKA | N_LINES | | | |
| | | | BANDSB | ROW_SPACING |
| MPDSRA | ROWS_IN_BLK | | | COL_SPACING |
| | COLS_IN_BLK | | | BAND_GSD |
| | | | | |
| MENSRB | ORP_ROW | | | |
| | ORP_COL | | | |
| | | | | |
| PATCHB | LNSTOP | | | |
| | A_Z_L | | | |
| | N_V_L | | | |
| | NPIXEL | | | |

Use of ICHIPB is highly recommended for reduced resolution imagery. ICHIPB must be used if IMAG precision is insufficient to specify the exact reduction ratio of the image.

## 4.8 Commercial SDEs

The commercial extensions are intended for use with imagery produced by commercial sources of satellite imagery. These extensions provide for including ephemeris and sensor pointing information with each image. The specific extensions included in the Commercial SDEs are shown in the table below.

**Table E-4. Commercial Support Data Extensions (Com SDE)**

| *SDE IDENTIFIER* | *SCOPE* |
|---|---|
| TREs | |
| CSCCGA | Cloud Cover Grid Data |
| CSCRNA | Corner Footprints |
| CSDIDA | Dataset Identification |
| CSEPHA | Ephemeris Data |
| CSEXRA | Exploitation Reference Data |
| CSPROA | Processing Information |
| CSSFAA | Sensor Field Alignment Data |
| GEOLOB | Image, raster, or matrix data rectified consistently with geographic (lat/long) coordinate systems |
| GEOPSB | Geo-referencing parameters including datums, ellipsoids |
| HISTOA | Softcopy History |

| | |
|---|---|
| ICHIPB | Image Chip Information |
| J2KLRA | JPEG 2000 Support Data |
| MAPLOB | Image, raster, or matrix data rectified consistently with cartographic (E, N) coordinate systems |
| PIAIMC | Profile for Imagery Access |
| PRJPSB | Projection Parameters |
| RPC00B | Rapid Positioning Capability |
| STDIDC | Standard Identification |
| STREOB | Stereo Image Information |
| USE00A | Exploitation Usability |
| | |
| DESs | |
| CSATTA DES | Attitude Data DES |
| CSSHPA DES | Shapefile DES |

4.9 Miscellaneous SDEs

The extensions intended for specific applications can be used in conjunction with other extensions or alone as applicable to the specific scenario. The Miscellaneous SDEs are shown in the table below.

**Table E-5. Miscellaneous Support Data Extensions (Misc SDE)**

| *SDE IDENTIFIER* | *SCOPE* |
|---|---|
| TREs | |
| ENGRDA | Engineering Data |
| XMLDCA | XML Data TRE |
| | |
| DESs | |
| GMTI | Ground Moving Target Indicator |
| | |
| LIDARA DES | LiDAR NGA.IP.0003_1.0 2010-09-07 |
| TRE_OVERFLOW | Tagged Record Extension Overflow |
| XML Data Content | XML Data Extension Segment |

4.10 Tagged Record Extensions (TREs):

**Table E-6. TREs Alphabetically Listed**

| | | | |
|---|---|---|---|
| ACCHZB | CMETAA§ | GEOPSB | PRJPSB |
| ACCPOB | CSCCGA | GRDPSB | REGPTB |
| ACCVTB | CSCRNA | HISTOA | REGPTC |
| ACFTA§ | CSDIDA | ICHIPB | RELCCA |
| ACFTB | CSEPHA | J2KLRA | RPC00B |
| AIMIDA§ | CSEXRA | MAPLOB | SECTGA |
| AIMIDB | CSPROA | MENSRA§ | SENSRA§ |
| ARRATA | CSSFAA | MENSRB | SENSRB |
| ASTORA | ENGRDA | MPDSRA§ | SNSPSB |
| ATTPTA | EXOPTA | MSTGTA | SOURCB |
| BANDSA§ | EXPLTA§ | PATCHA§ | STDIDC |
| BANDSB | EXPLTB | PATCHB | STREOB |
| BLOCKA | FACCB | PIAIMC | USE00A |
| BNDPLB | GEOLOB | PIAPRD | XMLDCA |

§ - Deprecated

4.10.1 ACCHZB

Where the region or sub-region boundaries are coincident with both horizontal and vertical accuracy regions, then the accuracy regions may be combined in the same accuracy Support Data Extension ACCPO. Where the horizontal and vertical boundaries differ in whole or in part, then either totally distinct horizontal and vertical sub-regions may be defined (ACCHZ, ACCVT), or the two approaches may be mixed. ACCHZ defines the horizontal accuracy.

4.10.2 ACCPOB

This extension is dedicated to convey accuracy information where the boundaries of the horizontal and vertical regions are coincident. There may be many positional accuracy regions, possibly associated with vertical and horizontal accuracy regions conveyed respectively by the ACCVT and ACCHZ extensions. When vertical and horizontal accuracies are homogeneous over the whole extent of the Image Segment, the ACCPO extension contains a single positional accuracy region and the ACCVT and ACCHZ are not present.

4.10.3 ACCVTB

Where the region or sub-region boundaries are coincident with both horizontal and vertical accuracy regions, then the accuracy regions may be combined in the same accuracy Support Data Extension ACCPO. Where the horizontal and vertical boundaries differ in whole or in part, then either totally distinct horizontal and vertical sub-regions may be defined (ACCHZ, ACCVT), or the two approaches may be mixed. ACCVT defines the vertical accuracy.

4.10.4 ACFTB (ACFTA§)

ACFT is a required component of all airborne imagery files ACFT provides miscellaneous information unique to airborne sensors (e.g., Tail Number, Takeoff Time). A single ACFT extension, containing information relative to the capture of its associated image data will be placed in the respective subheader of every NSIF image segment.

4.10.5 AIMIDB (AIMIDA§)

AIMID is a required component of all airborne imagery files. It uniquely identifies the image source, and if part of a larger scene, locates the image within the scene. AIMID is used for storage and retrieval from standard imagery libraries. A single AIMID is placed in the respective subheader of every NSIF image segment. Data from AIMID are copied into the first forty characters of the image subheader IID2 field.

4.10.6 ARRATA

The Air Reconnaissance Requesting And Target Reporting (ARRATA) TRE is designed to provide semantic information about target identified on imagery according to the Stanag 3596. For each target type, only location and type are provided. A unique ARRATA TRE identifies the main target. The TRE has to be set in the NSIF file header within the user-defined header data (UDHD). The target geo-location is defined as image and geographic coordinates. If secondary target is visible, a dedicated ARRATA should be used for each target. TRE linked to secondary targets have to be set in the Image segment file header within the user-defined image data (UDID) field. Note, the ARRTRE TRE is not to be used to identify individual objects like aircraft on an airfield.

4.10.7 ASTORA

ASTORA extension provides a Tagged Record Extension which can support data from the ASTOR radar program.

4.10.8 ATTPTA

Provide spatial location for specific pixels in an image array. Arbitrary pixels within the array can be assigned a spatial location accompanied by other pertinent metadata such as accuracy and source history.

4.10.9 BANDSB (BANDSA§)

BANDS is defined to supplement information in the NSIF image subheader where additional band-specific parametric data is required. This data extension is placed in each image subheader as required. Each Band must be identified either by the wavelength of peak response (BANDPEAK), or the wavelengths of its edges (BANDLBOUNDn, BANDUBOUNDn).

4.10.10 BLOCKA

BLOCK is optional, but often needed for exploitation of imagery. It supports high precision geolocation of image corners (within 31cm). BLOCK is placed in the image subheader with the corresponding AIMID and ACFT extensions.

4.10.11 BNDPLB

This optional extension is dedicated to provide an accurate location of the significant data contained in the Image Segment. The coordinates of this bounding polygon refer to the absolute coordinate system defined in the GEOPS (and possibly in the PRJPS) extension.
The extension is called BNDPL.

4.10.12 CMETAA§

(This TRE is deprecated and replaced by the SICD & SIDD DESs.) CMETA provides the unique parameters required to properly interpret complex SAR imagery, and supports data stored in either Cartesian (I,Q) or Polar (M,f) format. A single CMETA is placed in the image subheader when the image contains complex SAR pixels. CMETA is used both separately and as part of Airborne SDE Set.

4.10.13 CSCCGA

The Cloud Cover Grid Data TRE (CSCCGA) provides support dada that identifies which image segment and sensors were used to create the cloud grid. CSCCHA also geometrically registers the cloud grid to the pixel grid of one of the image segments.

4.10.14 CSCRNA

The Corner Footprint TRE (CSCRNA) provides the geodetic latitude, longitude, and ground elevation at the four-corners of the sensor (sub-image) footprint (or MBR, if the footprint is of irregular shape).

4.10.15 CSDIDA

The Dataset Identification TRE (CSDIDA) provides basic information describing the data contained in the NITF file.

4.10.16 CSEPHA

The Ephemeris Data TRE (CSEPHA) provides detailed space vehicle ephemeris information. The CSEPHA TRE provides global information for the entire NITF dataset. The CSEPHA can be repeated as necessary if the number of ephemeris vectors exceeds 999 in order to contain all ephemeris data. The minimum number of ephemeris vectors is 7, 3 during the pre-imaging interval, and 3 during the post-imaging interval. When the number of ephemeris vectors exceeds 999 the remaining vectors are recorded across multiple instances of the CSEPHA TRE in time-sequence order, and shall be treated as a set for the imaging interval. If multiple CSEPHA TREs are required, there could exist a case where only one ephemeris vector is present in the last CSEPHA TRE. Therefore the range for NUM_EPHEM must be 001 to 999.

4.10.17 CSEXRA

The Exploitation Reference Data TRE (CSEXRA) provides exploitation support data -- acquisition, environment, and performance parameters. This TRE contains data about preprocessed imagery.

4.10.18 CSPROA

The Processing Information TRE (CSPROA) identifies processing options that were applied during image formation.

4.10.19 CSSFAA

The Sensor Field Alignment Data TRE (CSSFAA) provides information on detectors, sensor type, and field alignment including fields for the focal length and principal point offset components. This TRE provides global information for the entire NITF dataset.

4.10.20 ENGRDA

The ENGRD extension is a free form extension that uses a key-length-value (KLV) structure to allow engineering parameters to be defined and incorporated into an NSIF file. Without a predefined data dictionary, the extension is not generally intended to be interpreted automatically by NSIF readers, but rather displayed as text for manual use. However, because of the KLV structure of the data, sensor system developers can use the known keys to automatically decode the information and perform searches and analyses of the sensor performance.

4.10.21 EXOPTA/EXPLTB (EXPLTA[§])

EXOPT and EXPLT provide metadata that allow users' programs to determine if the image is suitable for the exploitation problem currently being performed. They contain some of the fields which would make up a standard directory entry. EXOPT is used for electro-optical and infrared imagery, while EXPLT is used for SAR sensor data. EXOPT and EXPLT extensions are optional. A single EXOPT or EXPLT is placed in the image subheader, after the corresponding AIMID and ACFT extensions.

4.10.22 FACCB

Attributes are used to describe characteristics of a feature or a matrix band. Each attribute is described within DIGEST by using attribute codes to represent the category of information. Attribute value format statements provide a computer interpretation for the attribute value data type (e.g., real, alphanumeric) and attribute values give quantitative/qualitative meaning to the attribute code. This extension is primarily dedicated to provide the description of the FACC Attributes defining the content of a matrix. The FACCB extension can be associated with any Image Segment using attribute codes from the DIGEST FACC (See DIGEST Part 4 – Annex B), but is dedicated to convey the definition of the FACC codes appearing in the ISUBCATn Fields of an Image Segment containing a matrix (the value of the ICAT Field is equal to MATR in this case). The FACCB provides also a mechanism allowing the use of codes that are not already in the DIGEST FACC, but which have been proposed to the DGIWG for registration. Note that the use of unregistered codes shall be assumed by the producer of the File.

Each attribute is identified by a unique three character alphanumeric code (label). There are two types of attribute values: coded and actual. A given attribute has only one type of value, which is specified in DIGEST Part 4 - Annex B. Coded values may range from 0 to 999. Real values are typically measurements like height, width, etc. while coded values have meaning given in a look-up table. The units of measurement associated with an attribute are abbreviated according to the units of measurement codes as detailed in DIGEST Part 3 Clause 7. All the codes appearing in the ISUBCATn Field of the

Image Segment shall be defined in the FACCB extension, as well as all the nominal codes appearing in the matrix when the attribute values are coded.

4.10.23 GEOLOB

For rectified data (rows and columns are aligned with the coordinate system axis) GEOLO provides the description of the link between the local coordinate system (rows and columns) and the absolute geographic coordinate system (longitude and latitude) defined by GEOPS. A single GEOLO is placed in the Image Subheader.

4.10.24 GEOPSB

GEOPS defines (possibly associated with the PRJPS extension) the absolute coordinate system to which the data is geo-referenced. This absolute coordinate system may be a geographic system or a cartographic (grid) coordinate system. A single GEOPS shall be placed in the XHD Field (or corresponding TRE_OVERFLOW DES) of a NSIF/NITF File.

4.10.25 GRDPSB

When the image, matrix, or raster data is not rectified, the geographic location of each pixel may be derived from a given set of location grids computed for a given elevation. A single GRDPS is placed in the Image Subheader. The coordinates expressed in the location grids refer to the absolute coordinate system defined in GEOPS (and possibly PRJPS).

4.10.26 HISTOA

HISTO provides a history of the softcopy processing functions that are applied to the NSIF imagery by softcopy exploitation systems. HISTO records type and depth of compression, rotations, sharpening, scaling, pixel remapping, etc. HISTO is optional. HISTO is used both separately and as part of Airborne SDE Set.

4.10.27 ICHIPB

ICHIP provides the data needed to mensurate and calculate feature geopositions in imagery chips where the NSIF image subheaders are unchanged and continue to represent the original images. ICHIP is optional. ICHIP is used both separately and as part of Airborne SDE Set.

4.10.28 J2KLRA

This extension provides the support data to allow users of JPEG 200-compressed imagery to allow providers and users of NPJE, EPJE and TPJE data to quickly access the compressed data, but is available to be used by other encodings. The TRE provides users information about number of resolution levels, number of quality layers, and number of bands in both the original data and derived products. This information may be critical in the selection and ordering of data from a library. The J2KLRA TRE is recommended to be included with any original compressed data and compliant derived compressed products (i.e., parsing and repackaging).

4.10.29 MAPLOB

For rectified data (rows and columns are aligned with the coordinate system axis) MAPLO provides the description of the link between the local coordinate system (rows and columns) and the absolute cartographic coordinate system (Easting and Northing) defined by GEOPS and PRJPS. A single MAPLO is placed in the Image Subheader.

4.10.30 MENSRB / MPDSRA§ (MENSRA§/)

MENSR provides the collection geometry parameters required by image mensuration programs. MPDSR provides additional information required by many advanced image mensuration programs. MPDSR is designed to be used with the information contained in a companion BLOCK extension (identified by BLK_NUM) supporting the same image block. MPDSR is used for electro-optical and infrared imagery, while MENSR is used for SAR sensor data. MENSR and MPDSR are both optional, but their use will allow more accurate mensuration.

4.10.31 MSTGTA

MSTGT provides information from the collection plan associated with the image, and should identify specific targets contained within the image. However, due to collection geometry, a referenced target may not actually correspond to the area contained in the image. Use of MSTGT is optional.

4.10.32 PATCHB (PATCHA§)

PATCH provides information describing a portion of an image to support exploitation. In order to achieve the specified resolution in a SAR image, the phase history data must be continuously collected over a calculated flight path distance; this batch of phase history is then processed into one SAR image patch. A search scene typically consists of many abutting or overlapping patches; each patch of the scene may be treated as an independent image and placed into a separate file, or placed into separate NSIF image segments within a single file; where multiple patches of a scene exactly abut to form a mosaic image, they may all (up to 999) be placed into a single NSIF image segment. PATCH contains support data pertaining to a single image patch, and one PATCH extension is created for each image patch. The PATCH_TOT field of the ACFT extension contains the total number of patches contained in the NSIF image segment (and corresponding PATCH extensions contained in the image subheader). For spot modes there will normally be only one patch, and the corresponding PATCH may be omitted if all necessary information appears elsewhere in the file. PATCH extensions are placed in the subheader of the image containing the described patch.

4.10.33 PIAIMC

This support extension is designed to provide an area to place fields not currently carried in NSIF but are contained in the Standards Profile for Imagery Access (SPIA). Most imagery related information is contained in the NSIF main headers and Support Data Extensions (SDEs). The purpose of this extension is to minimize redundant fields while providing space for all information. This extension shall be present no more than once for each image in the NITF file. When present, this extension shall be contained within the image extended subheader data field of the image subheader or within an overflow DES if there is insufficient room to place the entire extension within the image extended subheader data field. This extension may alternatively be placed in the file header, either the extended header or the user-defined header locations, when the information it contains pertains to more than one image segment in the file.

4.10.34 PIAPRD

PIAPR contains producer identification needed by the NSILI (NATO STANAG 4559) imagery libraries. A single PIAPR is placed in the NSIF file header. Use of PIAPR is optional.

4.10.35 PRJPSB

The PRJPS extension contains the projection parameters of the absolute coordinate system when it's a cartographic (grid) coordinate system. This extension shall be present when the coordinate units (GEOPS.UNI Field) are Metres (M). PRJPS is necessarily associated with a single GEOPS extension and shall be placed in the same Field or TRE_OVERFLOW DES.

4.10.36 REGPTB

Registration points may be provided for image or map data to identify specific pixels in this data and provide spatial locations (geographic or cartographic) for these pixels. With this information, the entire image or map pixel set can be adjusted to improve overall accuracy. The extension is called REGPT. The coordinates of the registration points refer to the absolute coordinate system defined in GEOPS (and possibly PRJPS).

4.10.37 RPC00B

RPC00 contains rational function polynomial coefficients and normalization parameters that define the physical relationship between image coordinates and ground coordinates. Use of RPC00 is optional.

4.10.38 SECTGA

SECTG is an optional extension identifying a secondary target tasked in the original collection (that may not be present in a derived image). As many as 250 SECTGA extensions can exist in a single NSIF file, with the N_SEC field of EXOPT or EXPLT providing the total count. Either SEC_ID, SEC_BE, or both must contain a valid identifier.

4.10.39 SENSRB

The SENSRB extension provides information about the electro-optical (EO) sensor that collected the image data. EO sensors may be passive or active; measuring and recording light—including infrared (IR), visible, or ultraviolet (UV)—either as a single broad panchromatic band or in multiple bands—as with multispectral, hyperspectral, or polarimetric sensors. EO sensors may be attached to airborne, ground-based, maritime, or spaceborne platforms that are either mobile or stationary. SENSRB is intended for applications where the earth’s surface is imaged; nevertheless, it may also accommodate the imaging of features or phenomena above or below the earth’s surface. SENSRB updates SENSRA with expanded system descriptions, improved sensor attitude definitions, and increased precision levels. This extension also now allows for sensor calibration parameters, time stamping, pixel referencing, and uncertainty estimates, which were not accommodated by SENSRA, but are required for various implementations and applications. The SENSRB extension(s) is(are) placed in the image subheader.

4.10.40 SNSPSB

The sensor parameters data extension can be used with or without (in this case some fields in the extension are not applicable) the spatial data extensions. When sensor parameters do not apply to the whole image, a set of bounding polygons defines the corresponding parts of the image. The following specifies the parameters defining the attributes of the image, sensor and platform, which are most currently used. These parameters are:

- identification of bands of image at capture stage;
- resolution and pixel spacing (space sampling) at capture stage;
- basic parameters such as identification of sensor and platform, date and time of capture, processing level of image (if any), attitude of sensor.

In addition, a way to include specific parameters for a specific sensor/platform (called additional auxiliary information) is proposed by giving the related information, for each specific parameter: identification, format, unit and value. For some sensors, there may be a large number of specific parameters; in that case, a better solution may be a dedicated sensor data extension. The attitude data are given relative to the orbital reference of the sensor. The additional auxiliary parameters can be character strings, integer, or floating point numeric values. The auxiliary parameter value format discriminates between the 3 possible cases. The precision (and units) of the numeric values defines the accuracy required by the location model.

4.10.41 SOURCB

The map source data extension (SOURC) provides extensive information about the source graphics (one or more). Since these sources are maps or charts, a cartographic (MAP) coordinate system applies and must include ellipsoid, datum, and projection data. In addition, if elevation or depth information is present on the source map, the vertical or sounding datum must be supplied. The map source data extension can be used with or without (in this case some fields in the extension are not applicable) the spatial data extensions. The source graphic may include several map insets and usually includes legend data that is important to capture as raster files. Insets have a specific coordinate system defined, which may be different for each one and different to the one used for the main source graphic. The mechanism is the same as for relative coordinate systems with the four corners of the inset interpreted as registration points. Relative coordinates give the location of the outside of the corners (as computed from the row and column number of each corner). Absolute coordinates will give the location of the inside of the corners. Both locations will be described in the same coordinate system as defined in the GEOPS (and possibly PRJPS) extension(s). The only coordinate conversion allowed is change of scale and offset. In northern latitudes, certain maps may include a grid overlay for convenience of navigation where longitude arcs are rapidly converging. The overlays normally include Grid North-Magnetic North Angle (GMA) and a Grid Convergence Angle (GCA). Note: When the primary grid displayed on the map is not strictly registered to the map projection, it is best to use the projection to which the primary grid is registered to the map projection. This allows the application to use the parameters of the source file for transforming the coordinates from the coordinate system of the Image Segment to the coordinate system displayed on the grid.

4.10.42 STDIDC

The Standard ID extension contains image identification data that supplements the image subheader. Some parameters in this extension may be used by NIIA compliant systems. A single STDID is placed in the image subheader; where several images relate to a single scene; an STDIDC may be placed in each applicable image subheader. Note: The fields ACQUISITION_DATE through END_ROW constitute an image ID which is used by other SDEs (e.g., STREOB) to designate unique images for associating imagery pairs or sets.

4.10.43 STREOB

The STREO extension provides links between several images that form a stereo set to allow exploitation of elevation information. Use of STREO is optional. There can be up to 3 STREO extensions per image.

4.10.44 USE00A

The Exploitation Usability extension is intended to allow a user program to determine if the image is usable for the exploitation problem currently being performed. It also contains some catalogue metadata.

4.10.45 XMLDCA

This TRE provides a mechanism for placing XML-formatted data content within NSIF/National Imagery Transmission Format (NITF)-formatted files

4.11 Data Extension Segments (DESs):

**Table E-7. DESs Alphabetically Listed**

| |
|---|
| CSATTA |
| CSSHPA |
| GMTI |
| LIDARA |
| SICD |
| SIDD |
| STREAMING_FILE_HEADER§ |
| TRE_OVERFLOW |
| XML_Data_Content |

§ - Deprecated

4.11.1 Attitude Data (CSATTA) DES

The Attitude Data DES (CSATTA) provides sensor attitude information needed to run the rigorous math model to perform geolocation and mensuration. This DES provides global information for the entire NITF dataset. The Attitude Data DES (CSATTA) can be repeated as necessary if the number of attitude reference points exceeds 9999 in order to contain all attitude data.

4.11.2 Shapefile (CSSHPA) DES

The Shapefile DES (CSSHPA) is a general wrapper structure for an ESRI Shapefile.

4.11.3 Ground Moving Target Indicator (GMTI) DES

The Ground Moving Target Indicator DES has been developed by a NATO technical support team under the direction of the JISRCG/Air Group IV and the ISR Integration Working Group (ISRIWG). The GMTI DES provides the unique parameters required to properly express GMTI data. This activity is linked to the development of STANAG 4607. STANAG 4607 will define the format for the GMTI data. This format can be used in a stand-alone mode or as a subset of NSIF or STANAG 7023, the NATO Primary Image Format (NPIF). When used with STANAG 4545, the STANAG 4607-formatted data is encapsulated in the GMTI DES. This DES provides the proper linkage to the NSIF file structure while not changing any of the fields of the GMTI data. See STANAG 4607 and the 4607 Implementation Guide, AEDP-7, for further information.

### 4.11.4 LIDARA DES

The LIDARA DES (LiDAR NGA.IP.0003_1.0 2010-09-07) is focused on LiDAR data collected via tactical airborne sensors. It promotes the use of the LAS file data structure within the NSIF file format, supplemented with a raster representation to facilitate storage, discovery, visualization and retrieval of LiDAR point cloud data from collection sources.

The American Society for Photogrammetry & Remote Sensing (ASPRS) is the owner of the LAS Specification.

The LAS file is intended to contain LIDAR point data records. The data combines GPS, IMU, and laser pulse range data to produce X, Y, and Z point data. The intention of the data format is to provide an open format that allows different LIDAR hardware and software tools to output data in a common format. The format contains binary data consisting of a header block, Variable Length Records, and point data.

All data is in little-endian format. The header block consists of a public block followed by Variable Length Records. The public block contains generic data such as point numbers and coordinate bounds. The Variable Length Records contain variable types of data including projection information, metadata, waveform packet information and user application data. Waveform Data Packets, if included, comprise the only record that can follow the Point Data Records. It is placed in this position to allow easy “stripping” or externalizing. This record is an Extended Variable Length Record (EVLR). The length of an EVLR is stored in an unsigned long long (8 byte field) allowing more storage area than a VLR.

The following data types are used in the LAS format definition. Note that these data types are conformant to the 1999 ANSI C Language Specification (ANSI/ISO/IEC 9899:1999 ("C99").

- char (1 byte)
- unsigned char (1 byte)
- short (2 bytes)
- unsigned short (2 bytes)
- long (4 bytes)
- unsigned long (4 bytes)
- long long (8 bytes)
- unsigned long long (8 bytes)
- double (8 byte IEEE floating point format)

### 4.11.5 Sensor Independent Complex Data (SICD)

The Sensor Independent Complex Data product is not a separate DES. Instead it describes the use of the XML_DATA_CONTENT DES for complex image data generated by Synthetic Aperture Radar (SAR) systems and their data processing elements. A SAR complex image is an intermediate data product. The real utility is in the products and measurements that may be derived from it. The quality of the pixel array (resolution, SNR, etc.), along with the set of metadata provided, are critical in generating the derived products. The “sensor independence” of the SICD product refers to the ability of the allowed pixel array and metadata options to accurately describe the image products from many sensors and data processing systems. Sensor independence does NOT mean that all products have the same format for the pixel array or the same set of metadata parameters.

### 4.11.6 Sensor Independent Derived Data (SIDD)

The Sensor Independent Derived Data product is not a separate DES. Instead it describes the use of the XML_DATA_CONTENT DES for complex image data generated by Synthetic Aperture Radar (SAR) systems and their data processing elements. SAR-derived image products, and their associated metadata, are grouped around common tasks for downstream users. The SIDD documentation provides specifications for these common tasks which are designed to support basic exploitation, geographic measurements, and proper visual display. Additionally, the documentation specifies the SIDD supported coordinate systems and product image pixel arrays. The real utility of SAR image collection is in the products and measurements that may be derived from it. The quality of the pixel array data along with the set of metadata provided are critical in generating the derived products. The “sensor independence” of the SIDD product refers to the ability of the allowed pixel array and metadata options to accurately describe the image products from sensors and data processing systems. Sensor independence does NOT mean that all products have the same format for the pixel array or the same set of metadata parameters.

#### 4.11.7 Streaming File Header (STREAMING_FILE_HEADER) DES

(§ - This DES has been deprecated and should no longer be used in new NSIF files. As of the writing of this document there were no known production systems making use of this DES.)

NSIF provides the STREAMING_FILE_HEADER§ to allow NSIF File creation or transfer before all NSIF File Header fields are populated. This extension is being phased out of the standard due to lack of use. The original requirement was for systems where there was insufficient processing power to completely handle the image prior to recording or transmission. Modern processing systems do not have these limitations, and as such, the extension is not used, Legacy versions of the standard contain the STREAMING_FILE_HEADER§ field names, sizes, value ranges, and types. When an intentionally incomplete NSIF File Header is encountered, the NSIF File shall be processed by using the NSIF File Header values located in the STREAMING_FILE_HEADER§. When used, the STREAMING_FILE_HEADER§ is located at or near the end of the NSIF File. To facilitate locating the DES, the STREAMING_FILE_HEADER§ contains two unique delimiter fields (SFH - Delimiter 1 (SFH-DELIM1) Field and SFH - Delimiter 2 (SFH-DELIM2) Field). The SFH-DELIM1 field precedes the STREAMING_FILE_HEADER§ and the SFH-DELIM2 field follows the STREAMING_FILE_HEADER§. The SFH-DELIM1 field is preceded by the SFH Length 1 (SFH-L1) Field and the SFH-DELIM2 field is followed by the SFH Length 2 (SFH-L2) Field. The SFH-L1 and SFH-L2 fields are placed to ensure valid delimiters are found. The value of the SFH-DELIM1 field shall be equal to the value of the SFH-DELIM2 field, the value of the SFH-L1 field shall be equal to the value of the SFH-L2 field, and the number of characters between the SFH-DELIM1 field and the SFH-DELIM2 field must be equal to the value of the SFH-L1 and SFH-L2 fields. The STREAMING_FILE_HEADER§ may contain a complete NSIF File Header, a subset of the NSIF File Header, or may extend beyond the NSIF File Header to include fields within the subsequent Image Subheader and beyond. If the NSIF File contains more than one DES, the STREAMING_FILE_HEADER§ shall be the final DES.

#### 4.11.8 Tagged Record Extension Overflow (TRE_OVERFLOW) DES

The TRE_OVERFLOW DES is used for encapsulating a series of TRE in a DES as overflow from the NSIF File Header or any Segment’s Subheader. A separate DES is used for each NSIF File Header or Subheader field that overflows. Which NSIF File Header or Subheader field overflowed is indicated in the DES Overflowed Header Type (DESOFLOW) Field and DES Data Segment Overflowed (DESITEM) Field contents. The TRE_OVERFLOW DES for encapsulating TRE is defined in the standard.

#### 4.11.9 XML Data Content DES

This DES provides a mechanism for placing XML-formatted data content within NSIF/NITF-formatted files.

# ANNEX F NSIF Configuration Management Plan

## 1. PURPOSE

The purpose of this document is to provide the framework for the management of STANAG 4545 and all associated documents.

### 1.1 Related Documents:

#### 1.1.1 Documents Included In This Configuration Management Structure:

STANAG 4545
AEDP-4; STANAG 4545 Implementation Guide
NSIF Web Registry
ISO BIIF Profiles:
- NATO Secondary Imagery Format, Version 01.01, (NSIF01.01)
- BIIF Profile for JPEG 2000, Version 01.10, (BPJ2K01.10)
- BIIF Profile for Computer Graphics Metafile, Version 01.00 (BPCGM01.00)

Other as designated by the STANAG 4545 Custodian

#### 1.1.2 Other Referenced Documents:

AAP-3 *Procedures for the Development, Preparation, Production, and the Updating of NATO Standardization Agreements (STANAGs) and Allied Publications (APs)*

## 2. SCOPE

This document provides the framework for configuration management of STANAG 4545 and all associated documents. The participating NATO member nations define their respective levels of participation and all NATO member nations have equal opportunity to have their respective positions voiced in the STANAG 4545 community. Decision made within this framework are subject to final approval of the parent organization, in order to ensure the proper placement of STANAG 4545 within the overall NATO Imagery Interoperability Architecture (NIIA). Overall, the configuration management structure is consistent with the NATO guidelines defined in AAP-3, *Procedures for the Development, Preparation, Production, and the Updating of NATO Standardization Agreements (STANAGs) and Allied Publications (APs)*.

The key element of the configuration management process is the management of requests for change by individual nations. However, part of the configuration management process is the coordination with the International Standards Organization (ISO). ISO has developed a standard, the Basic Imagery Interchange Format (BIIF), which has the same structure as STANAG 4545. NATO has submitted a profile for BIIF that includes all of the parameters of this STANAG. As changes are made that impact the profile, a new profile will have to be submitted for BIIF, and coordinated through the ISO profile process.

## 3. STANAG MANAGEMENT ORGANIZATION

### 3.1 General

3.1.1 Each NATO member nation is responsible for funding its own participation. Although each NATO member nation can assign representatives to the STANAG activities defined herein, any assigned representatives are expected to be active participants.

3.1.2 Should the STANAG 4545 Custodian be unable to properly execute business due to repeated lack of participation at the meetings, the Custodian shall report the lack of participation to the parent organization, who shall request that the representative of the respective nation(s) to either withdraw from STANAG 4545 participation or appoint a new STANAG 4545 representative who will be able to fully participate.

### 3.2 Custodian/Chairman

The STANAG 4545 Custodian also serves as the chairman of all meetings of the configuration management functions. The Custodian is responsible for all STANAG 4545 activity. Specific duties include, but are not limited to the following tasks.

- Tracks changes and provides "official" copy for promulgation
- Reports to the parent organization on status
- Chairs STANAG 4545 Custodial Support Team (CST) meetings
- Directs activity of STANAG 4545 Administrative Support Team (AST)

3.2.1 The Custodian is the only individual to receive tasking from and report to the parent organization on STANAG 4545. This authority can be delegated to other members of the STANAG 4545 community, but responsibility for the tasking and reporting resides with the Custodian.

### 3.3 STANAG 4545 Custodial Support Team (4545 CST)

The Custodial Support Team decides on the changes to be made to STANAG 4545.

3.3.1 STANAG 4545 Representatives; Representatives to the 4545 CST are appointed by the respective national representative to the parent organization. Each NATO member nation can appoint a representative to the 4545 CST by providing the name, organization, address, telephone and facsimile numbers, and electronic mail address of their 4545 CST member to the STANAG 4545 Custodian. (The STANAG 4545 Custodian will document the members of the 4545 CST and provide the information to the NATO Secretary for recording in the parent organization decision sheet.) The national representative to the 4545 CST can be from government or industry as chosen by the national representative to the parent organization. The national representative to the 4545 CST is the official spokesman for all participants from that nation.

3.3.2 Each national representative shall define procedures for establishing the respective national position on proposed changes. These procedures can use whatever process is appropriate to that nation, but ultimately the national representative will voice the official national position to the 4545 CST.

3.3.3 The authority of the national representative can be delegated to another individual from that nation in absence of the national representative. The delegation shall be in writing to the Custodian/chairman prior to the start of the meeting at which the delegation of authority is effective. The substitute representative shall have all authority and responsibility of the regular representative.

3.3.4 Other individuals from nations with representatives may participate at discretion of national representatives or the Custodian/chairman. The participants can be additional government personnel or contractor personnel. The intent of having additional personnel participate is to provide technical, operational, or procedural expertise that may not be resident with the representatives and to allow participation by those who are developing systems using STANAG 4545.

3.3.5 Individuals from non-NATO nations may participate in 4545 CST meetings only at the approval of the Custodian, and only to explain/defend changes proposed by the individual or a represented non-NATO nation or to provide unique expertise.

3.4 STANAG 4545 Administrative Support Team (4545 AST)

The STANAG 4545 Administrative Support Team provides the necessary planning and maintenance activities to manage STANAG 4545 and related documents.

3.4.1 The members of the 4545 AST are selected by Custodian. Members are selected based on tasking, resources, and remain members of the 4545 AST at the discretion of the Custodian.

3.4.2 The members of the 4545 AST will perform the following functions.

- Prepare for meetings by identifying locations and dates for the meetings, preparing announcements, coordinating security clearances, providing guidance to meeting hosts, and preparing presentation materials and handouts.
- Presentation of recommended changes during the meetings.
- Track recommended changes submitted through 4545 CST channels.
- Prepare minutes of all meetings.
- Prepare revisions for distribution to NATO Secretary and members.
- Perform the configuration management STANAG 4545, including maintaining the current version of document.
- Disseminate all proposed changes to the 4545 CST as they are received and logged.

3.5 NATO Secretary

The NATO Secretary is responsible for maintaining the configuration management of the NSIF web page on which registry information is posted.

3.5.1 The Secretary will update the postings for past and upcoming meetings based on information provided by the Custodian.

3.5.2 Once changes to STANAG 4545 are approved, the Secretary will post the revision to the NSIF web page within 60 days of the meeting, unless other arrangements are agreed during the 4545 CST meeting.

3.6 Special Teams

The Custodian shall have the authority to convene special teams to examine major technical issues that are beyond the scope of routine change proposal activity. Technical issues of this type can include major changes to the format or development of future strategies for image interoperability. The Custodian can chair the special team or select another member of the NSIF community to chair the special team and report on its progress. The members of the team will be appointed by the Custodian based on recommendations from the national representatives. The Custodian will identify any special teams, including the members, tasking, planned schedule, and expected products, to the parent organization.

## 4. CHANGE IDENTIFICATION

4.1 All representatives can submit change requests that change the content or structure of STANAG 4545. The approval process for changes to approved extensions or proposals for new extensions will be made using the same procedures as for changes to the standard with the exception that a different submission form is used. Personnel requesting changes shall submit their requests through the respective national representatives. For persons from NATO nations without formal representatives on the 4545 CST, the change requests shall be submitted through their respective parent organization representative.

4.1.1 Individuals from non-NATO nations may submit change proposals directly to the Custodian. In addition to the information contained in the standard change request form (ANNEX G Forms for Requesting Changes to Documents Or Proposing New Extensions), the submission shall include a cover letter which clearly identifies the name, title, organization, and contact information of the submitter, as well as a statement as to whether the submission is in response to a national government requirement. If the change supports a national government requirement, the requirement should be identified, and an endorsement included which is signed by an appropriate government representative. In all cases, the submitter should be prepared to attend the 4545 CST meeting to explain and/or defend the proposed change.

4.2 All change requests shall use a standard format, either by completing the form in ANNEX G or electronic mail containing the same information and order as the form. The paper form can be submitted either through the mail or by telefax. The change request is submitted to the appropriate national representative, who then endorses the change and forwards it to the Custodian. The Custodian provides the change request to the 4545 AST for logging and dissemination for discussion and review. For changes to the standard, block 1 will identify the standard and block 2 will identify the edition and amendment number to which the change will apply.

4.3 All change requests shall identify the proposed change as either Class I (amendments of substance) or Class II (editorial amendments). Class I changes modify the functionality of standard (requires s/w change to comply). This includes changes to the order of fields, changes to the allowed or required values for a field, or additions/deletions of fields or approved values. Class I changes are those identified as changes of substance in paragraph 212.2. of AAP-3(I). Class II changes are for administrative or editorial revisions or to clarify the usage of the STANAG. These changes are those identified as editorial amendments in paragraph 212.3 of AAP-3(I). Class II also includes those values shown in the STANAG as examples, and which are managed as a list in the NSIF Registry. All changes to existing extensions or proposals for new extensions are Class II changes.

4.4 Extensions to the standard will also be managed by the 4545 CST. Proposals for new extensions will be submitted through the same channels as changes to the STANAG text. The change proposal for a new extension will use the new extension request form (see ANNEX G Forms for Requesting Changes to Documents Or Proposing New Extensions). Proposed extensions will be forwarded to all national POCs for review and discussed during the next 4545 CST meeting. A list of approved extensions will be posted to the NSIF web page.

4.5 Additional values for fields can also be submitted for consideration by the 4545 CST. Additional field values should be submitted using the form in ANNEX G , identifying the field affected in Block 4, and describing the reasons for the additional value in the justification block.

## 5. CONFIGURATION MANAGEMENT

Configuration Management, as defined in AAP-3(I), defines the top level process. It specifies that once changes are produced, they should be forwarded to the NATO Standardization Agency (NSA). AAP-3(I) does not specify the process within the sponsoring agency or for the Custodian to use in recording proposed changes and managing the change approval process. The primary purpose of this plan is to specify the process to be used by the STANAG 4545 Custodian.

The STANAG 4545 Configuration Management will be conducted on a cyclic basis. The process is shown in Figure 1. Changes can be submitted at any time, but will be reviewed by the 4545 CST on a regular basis as required. Presentations to the parent organization will be performed on a semiannual basis to coincide with the regular meetings. Submissions to ISO for the profiles of BIIF, JPEG2000, and CGM will be performed as required.

### 5.1 Routine Business Activities

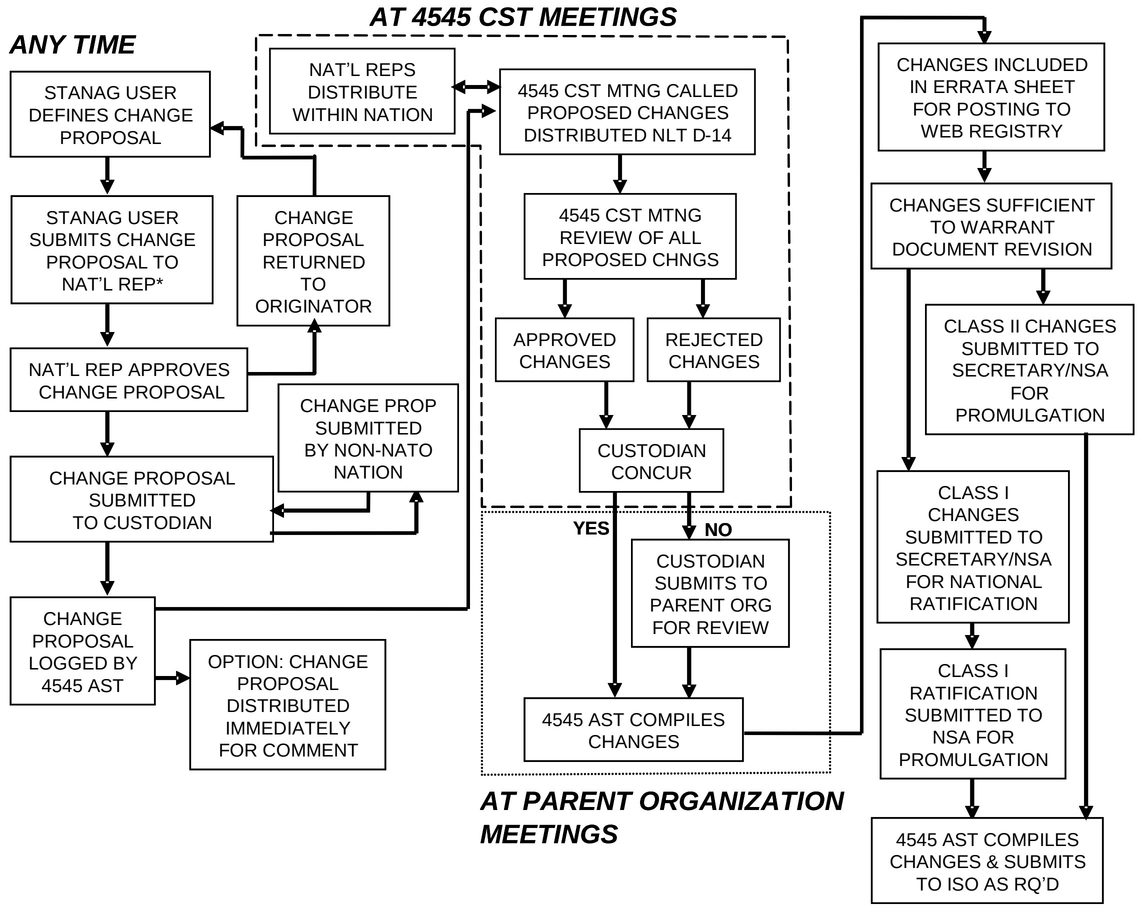
These activities can be performed at any time by the appropriate personnel.

5.1.1 Change requests are submitted by any interested individual or organization as described above using the forms included in ANNEX G . A list of NATO national representatives will be maintained by the NATO Secretary.

5.1.2 The national representatives have disapproval authority over any proposed change from their respective nation prior to submission to the Custodian. If approved, the national representative endorses the change request and forwards the change request to the Custodian. If the national representative disapproves the proposal, the change proposal form is annotated with the reasons for the disapproval and it is returned to the submitter.

5.1.3 Direct submission by representatives from non-NATO nations is authorized. Change request submissions from individuals in non-NATO nations are submitted directly to the Custodian. The Custodian shall review the submissions and approve for 4545 CST consideration those proposals that have potential benefit to the NATO community. Rejected proposals are returned to the submitter with the reasons for rejection.

## Table F-1. CM Process Flow




5.1.4 The Custodian provides the change requests to the 4545 AST for logging into the configuration management system. At the direction of the Custodian, proposed changes can be disseminated by the 4545 AST at any time for review and comment.

5.2 Regular 4545 CST Meetings

The 4545 CST shall meet regularly unless there are no outstanding change proposals. The Custodian will formally call the meeting based on the arrangements established by the 4545 AST.

5.2.1 Proposed changes are compiled and distributed to all national representatives and other regular attendees no less than ten days prior to the meeting. National representatives distribute the proposed changes to other interested individuals from the respective nation. National representatives and others are directed to establish impact of the proposed changes. The respective national positions are determined by procedures established by each nation. If a nation is unable to attend a 4545 CST meeting, the nation may submit written comments to the Custodian prior to the 4545 CST meeting. The comments will be provided to all attendees for consideration during deliberations.

5.2.2 During the 4545 CST meeting, each proposed change is discussed. Change proposals are discussed under direction of the Custodian. Change proposals can be deferred pending additional investigation/review, for which the Custodian assigns responsibility for additional study/review, or changes can be voted independently or in groups at discretion of Custodian.

5.2.2.1 Final configuration decisions are voted only by the national representatives. Class I changes require unanimous consent of national representatives (or designated alternates) in attendance and voting. Class II changes require a majority vote of national representatives in attendance and voting. Ties are decided by the Custodian.

5.2.2.2 The Custodian can defer the decisions of the national representatives for parent organization review, request additional discussion and review by the national representatives, or approve them immediately. Approved decisions are incorporated into an errata sheet for the STANAG by the 4545 AST. Approved changes are maintained in the errata sheet until the Custodian determines that sufficient items have been approved to warrant a change to the document. When deemed necessary by the Custodian, unapproved decisions are presented to the parent organization for final decision. Those changes approved by the Custodian or ratified by the parent organization are incorporated into the STANAG errata sheet by the 4545 AST.

5.3 Parent Organization Meetings

At the parent organization meetings, two topics are presented along with the general status of the STANAG 4545 activities.

5.3.1 The Custodian can present any change proposals approved or rejected by the 4545 CST for which the Custodian disagreed. The parent organization makes the final decisions on those items presented for which the Custodian disagreed with the 4545 CST national representatives. The 4545 AST then incorporates the revisions as directed by the parent organization.

5.3.2 In addition, the Custodian presents to the parent a summary of the changes that were approved by the CST. Revisions with Class I changes are then submitted to the NATO Secretary to formally present the modifications through NSA to the nations for ratification. Revisions with only Class II changes are considered ratified with chain of command approval. Regardless of the ratification process used, after ratification, the Secretary posts the revised STANAG to the NSIF web page and submits it to the Chairman of the NSA for promulgation.

5.4 ISO Submission

If the changes affect the profile as submitted for BIIF, then a new profile may be required. Changes which are substantial will generally require an immediate change. Less substantial changes may be recorded in a revision to the STANAG, showing the pen and ink changes to be made to the BIIF profile. The decision whether or not to record a new BIIF profile is left to the Custodian, based on recommendations from the national representatives. If a revision is appropriate, the 4545 AST prepares the revised profile and submits it to ISO for approval. Upon receipt of the revised profile identification, the NATO documentation is updated as either an administrative change or as a technical change requiring ratification and promulgation.

## 6. MEETING PROCEDURES

6.1 All meetings will be conducted in English. Those nations requiring the materials in different languages are responsible for translating the materials. Attendees to the meetings should be proficient enough in English to contribute to the meeting in English.

6.2 All meetings will be announced with a minimum of 60 days notice.

6.3 The quorum for approving changes for submission to the parent organization is 2 nations formally represented by approved representatives or their alternates.

6.4 Minutes of all formal meetings will be distributed within 30 days of the completion of the meeting. The minutes will include a record to document approved and disapproved changes, identify the status of all outstanding changes, and identify issues to be taken forward to the parent organization.

6.5 If, because of disagreement between the Custodian and the majority of national representatives, items are taken forward to the parent organization for a final decision, the Custodian and 4545 AST will prepare a memorandum for record, distributed to all national representatives, which will identify results of the parent organization discussions/decisions, and provide status of all changes reviewed. This memorandum will be disseminated to the national representatives within 30 days of the parent organization meeting.

# ANNEX G Forms for Requesting Changes to Documents Or Proposing New Extensions

# STANDARDIZATION DOCUMENT CHANGE PROPOSAL

**INSTRUCTIONS**

1. Change proposals may be submitted on this form through either mail or telefax, or by electronic mail following the same order and content as this form.
2. Originator completes sections 1-16.
3. Originator forwards to the respective national representative. National representative is official representative to 4545 CST, or if none from the originator's nation, then the representative to the JISRCG. (See the NATO NAFAG JISRCG Internet web page for names and addresses.)
4. National representative approves or rejects proposal from their nation by completing sections 17-25.
   - Approved proposals are forwarded to the STANAG 4545 Custodian.
   - Rejected proposals are annotated with the reason for disapproval and returned to the originator.

Note: This form may be used to submit changes to any document included in the STANAG 4545 data set. This form may not be used to request copies of these documents. The documents are available on the NATO NAFAG NSIF Internet home page (www.nato.int/structur/AC/224/standard/4545/4545.htm), or through normal NATO document distribution channels.

**RECOMMENDED CHANGE:** (continue on additional sheets as necessary) page | | of | |

| | | |
|---|---|---|
| 1. Document Number: | 2. Document Version/Release Number: | 3. Document Date: |

4. Document Title:

| | |
|---|---|
| 5. Proposed Change to: (Section, Paragraph, Line, Page) | 6. Change Class: I | | II | | |
| 7. Current Wording: | 8. Proposed Wording: |

9. Reason/Rationale:

| | |
|---|---|
| 10. Originator's Name: | 13. Originator's Telephone Number: |
| 11. Originator's Organization: | 14. Originator's Telefax Number: |
| 12. Originator's Mailing Address: | 15. Originator's E-Mail Address:<br>16. Date Submitted: |
| 17. Nat'l Rep Name: | 20. Nat'l Rep Telephone Number: |
| 18. Nat'l Rep Organization: | 21. Nat'l Rep Telefax Number: |
| 19. Nat'l Rep Mailing Address: | 22. Nat'l Rep E-Mail Address:<br>23. Date of Approval/Rejection: |

24. Change Proposal: Approved |__| Rejected: |__|
25. Rejection Rationale:

| | |
|---|---|
| Mail, Telefax, or E-Mail Change Proposals To:<br>STANAG 4545 Custodian | 26. Date Logged by 4545 AST/initials: |

# DATA EXTENSION CREATION PROPOSAL

INSTRUCTIONS

1. Data Extension proposals may be submitted on this form through either mail or telefax, or by electronic mail following the same order and content as this form.
2. Originator completes sections 1-13.
3. Originator forwards to the respective national representative. National representative is official representative to 4545 CST, or if none from the originator's nation, then the representative to JCGISR. (See the NATO NAFAG JCGISR Internet web page for names and addresses.)
4. National representative approves or rejects proposal from their nation by completing sections 17-25.
   - Approved proposals are forwarded to the STANAG 4545 Custodian.
   - Rejected proposals are annotated with the reason for disapproval and returned to the originator.

## New Proposed Extension

(Attach document including description, instructions and all necessary data fields to this form)

| 1. Extension Name | 2. Extension ID | 3. Version Number / Letter | 4. Extension Type TRE ☐ DES ☐ |
|---|---|---|---|

5. Brief Extension Description

6. Reason for Extension proposal

| | |
|---|---|
| 7. Originator's Name | 8. Originator's Telephone Number |
| 9. Originator's Organization | 10. Originator's Telefax Number |
| 11. Originator's Mailing Address | 12. Originator's Email Address |
| | 13. Date Submitted |
| 14. Nat'l Rep's Name | 15. Nat'l Rep's Telephone Number |
| 16. Nat'l Rep's Organization | 17. Nat'l Rep's Telefax Number |
| 11. Nat'l Rep's Mailing Address | 18. Nat'l Rep's Email Address |
| | 19. Date of Approval / Rejection |

20. Data Extension Proposal — Approved ☐ Rejected ☐
21. Rejection Rational

| | |
|---|---|
| Mail, Telefax, or Email Extension Proposals To:<br>STANAG 4545 Custodian | 22. Date logged by 4545 AST initials: |

# ANNEX H DIGEST Extensions Errata/Configuration Management

1.0 The NATO STANAG 7074 DIGEST standard provides the basis for exchanging geographic and cartographic information. Some of the extensions defined in DIGEST are also used within NSIF files. The DIGEST was created by the Defense Geographic Information Working Group (DGIWG). However, the DGIWG is working to transition to new technologies and is not going to support change proposals to the existing STANAG 7074 materials. Since some of the extensions are being upgraded by the NSIF community, it was agreed in a joint DGIWG/STANAG 4545 CST meeting in September 2005 that the 4545 CST will manage any future changes to DIGEST extensions. This Annex provides the changes that have been adopted within the NSIF community. Changes will be identified in both this document and the NSIF web-based Registry. The table below identifies changes for DIGEST 2.1, Part 2, Annex D.

## Table H-1. DIGEST Extensions Errata/Configuration Management

| Item | Reference | Current Text | Requested Text | Rationale |
|---|---|---|---|---|
| 1 | NUM_PTS Field of BNDPL, ACCPO, ACCHZ, ACCVT, SNSPS and SOURC TREs; Pages D1-17, 20, 22, 23, 25, 34 | The first and last points shall be the same. | The first and last points can be the same, but are not required to be. | Since it is not necessary to repeat the first and last point, it should not be a requirement to do so. |
| 2 | GEOPS TRE, Page D1-10, paragraph D1.2.7.1 | A single GEOPS shall be placed in the XHD Field (or corresponding TRE_OVERFLOW DES) of a NSIF/NITF File. | A single GEOPS can be placed in the XHD field (or corresponding TRE_OVERFLOW DES of a NSIF/NITF file. In this case, the GEOPS must be applicable to all the Image Segments in the file. Alternatively, a single GEOPS can be placed in the IXSHD field (or corresponding TRE_OVERFLOW DES of a NSIF/NITF file) of each Image Segment warranting a GEOPS. This case will accommodate multiple image segments in a file that have different geo-referencing parameters or instances where being explicit are warranted. | Accommodates for multiple image segments in a file that have different geo-referencing parameters or instances where being explicit are warranted. |
| 3 | paragraph D1.2.3 Rectified Image/Raster Local Coordinate System, Page D1-5 | None. | Between the first and second sentence, insert the following sentence:<br>This allows for four possible geographic orientations of the NSIF raster array: North-up, South-up, East-up, West-up. | Clarification. |

| Item | Reference | Current Text | Requested Text | Rationale |
|---|---|---|---|---|
| 4 | paragraph D1.2.3 Rectified Image/Raster Local Coordinate System, Page D1-5 | All of the second paragraph, including sub sections a and b | The calculation of geographic coordinates of any row, column location can be obtained through linear interpolation using the GEOPS, LSO, PSO, ARV and BRV parameters. | The equations provided do not work for all geographic quadrants and orientations. Replacement equations are desired, but not fully developed at this time. The NSIF CST will submit a replacement set of equations once developed and tested. |
| 5 | ATTPTA TRE | None | Incorporate the ATTPTA into the AEDP. | New TRE for community usage. |
| 6 | REGPTC | REGPTB | Incorporate the REGPTC into the AEDP. | Updated TRE for community usage. |

§ - Deprecated

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# ALLIED ENGINEERING DOCUMENTATION PUBLICATION AEDP-4 Edition 2

# NATO Secondary Imagery Format (NSIF) STANAG 4545 (Edition 2)
# Implementation Guide